MONTHLY WEATHER REVIEW.

WASHINGTON, D. C., DECEMBER, 1882.

INTRODUCTION.

This REVIEW presents a general summary of the meteorological conditions which prevailed over the United States and adjoining territories during the month of December, 1882, and a brief description of the storms occurring in the north Atlantic ocean, as determined from reports of observations taken at 7.00, Washington mean time, and received at this office up to January 20th.

The most marked features of the month have been:

1st.—The low temperature which occurred in the Southern states, especially at stations on the Gulf coast and in Florida, the average being 3° below the mean of December. The low temperature was, in a great measure, due to the cold wave of the 15th, 16th, and 17th, during the continuance of which killing frosts occurred as far south as central Florida. Information of its advance was telegraphed from this office to the sugar and fruit regions of the south, and the Signal Service observers report that the timely warnings thus given were worth thousands of dollars to the sugar interests.

2d.—The high mean temperature which prevailed in the Rocky mountain region. Generally, the month was colder than the mean of December, east of the Rocky mountains, and warmer than the mean in that region, and thence westward to the Pacific coast. The only exception to this occurred in the lower Missouri valley, where the temperature averaged 0°.5 above the mean for the month.

3d.—The rainfall of the month was generally below the December average, except in the lake region, the south Atlantic states, the Florida peninsula, and in the north Pacific region. In the last-mentioned district, the excess was unusually large; at Portland, Oregon, the rainfall reached the unprecedented amount of 20.14 inches, and destructive floods occurred in that vicinity. In the middle Pacific coast region, the deficiency was equally marked.

That part of the REVIEW referring to International Meteorology presents the general weather conditions which prevailed over the northern hemisphere during the month of October, 1880. The prominent meteorological feature of the month was the unusually low temperature that prevailed in Europe,—the month having been one of the coldest Octobers on record, (see NOTES and EXTRACTS.) The October rainfall, in Europe, was also very much in excess of the average; in central and western Europe the monthly rainfall being more than double the October average. In the United States, the weather conditions differed but slightly from the normal. Chart v. exhibits the paths of barometric minima during January, 1881. The depression charted as low-area xxi. is especially noteworthy on account of the phenomenally heavy snowfalls that accompanied it in Europe.

In the preparation of this REVIEW, the following data received up to Janurry 20th, have been used; viz.: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty-six Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and eighty-eight monthly journals, and one hundred and eighty monthly means from the former, and fourteen monthly means from the latter; two hundred and sixteen monthly registers from voluntary observers; fifty-two monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; Marine Reports, through the co-operation of the "New York Herald Weather Service;" abstracts of Ships' Logs, furnished by the publishers of "The New York Maritime Register;" monthly reports from the local weather services of Indiana, Kansas, Nebraska, and Missouri, and of the Central Pacific railway company; extracts from the Iowa Weather Bulletin for December, 1882; trustworthy newspaper extracts; and special reports.

BAROMETRIC PRESSURE.

[*Expressed in inches and hundredths.*]

The mean barometric pressure for the month of December, 1882, over the United States and Canada, is shown by the isobarometric lines (in black) on chart ii.

The region of greatest mean pressure occupies an area extending from Oregon and Nevada eastward and northeastward to the Missouri valley and the extreme northwest, and is inclosed by the isobar of 30.25. The highest monthly mean pressures reported are, Salt Lake City, Utah, and Fort Buford, Dakota, 30.27; and Pike's Peak, Colorado, 30.28. The isobar of 30.15 incloses nearly the whole of the United States west of the ninety-fifth meridian, and also a large area extending eastward of that meridian to the Atlantic, and from the Gulf of Mexico northward to the fortieth parallel. From the region of highest mean pressure, the monthly means decrease to 30.1 at Portland, in the north Pacific coast region; and to 30.04 and 30.06 at Yuma and San Diego, respectively, in the south Pacific coast region. An area of low mean pressure covers the Canadian Maritime Provinces and New England. The lowest monthly means reported are, Sydney, Nova Scotia, 29.86; Charlottetown, Prince Edward Island, 29.90, and Halifax, Nova Scotia, 29.94.

Compared with the means of the previous month, the pressure is from 0.01 to 0.04 higher in the south Atlantic states and in Florida; in the extreme northwest and in the upper Missouri valley, there is an increase of from 0.01 to 0.06; on the Pacific coast from Visalia, California, to Roseburg, Oregon, there is an increase varying from 0.01 to 0.09. In all other districts, the pressure is lower. In New England, the decrease varies from 0.05 to 0.12; in the lake region, from 0.02 to 0.12; in the middle slope, from 0.05 to 0.16; elsewhere the decrease is less marked.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the means of previous years, no marked departures have occurred. In the middle and south Atlantic states, Tennessee and the Ohio valley, there has been a slight increase varying from normal to 0.03 above. From New England westward to the Mississippi river, the pressure is from normal to 0.06 below. From the Mississippi westward to the Pacific coast, the departures are from normal to 0.08 above, except at stations in southern California, and on the west Gulf coast, where the pressure is slightly below the normal.

BAROMETRIC RANGES.

The barometric ranges have varied from 0.50 to 1.54, the smallest being reported from Tucson, Arizona, and the greatest from Saint Louis, Missouri. In the several districts the ranges have been as follows:

New England.—From 0.91 at Block Island and Narragansett Pier, Rhode Island, to 1.18 at Portland, Maine and Mount Washington, New Hampshire.

Middle Atlantic states.—From 0.81 at New York City, to 0.99 at Albany, New York.

South Atlantic states.—From 0.75 at Atlanta, Georgia, to 0.95 at Hatteras, North Carolina.

Florida peninsula.—From 0.57 at Key West, to 0.78 at Cedar Keys.

Eastern Gulf states.—From 0.88 at Montgomery, Alabama and Pensacola, Florida, to 1.10 at Starkville, and 1.12 at Vicksburg, Mississippi.

Western Gulf states.—From 0.88 at Port Eads, Louisiana and 0.98 at Galveston, Texas, to 1.50 at Little Rock and 1.53 at Fort Smith, Arkansas.

Ohio valley and Tennessee.—From 0.86 at Chattanooga and Knoxville, Tennessee, to 1.32 at Champaign, Illinois.

Lower lake region.—From 0.81 at Detroit, Michigan, to 0.98 at Oswego, New York.

Upper lake region.—From 0.88 at Port Huron, Michigan, to 1.16 at Chicago, Illinois, and 1.18 at Duluth, Minnesota.

Extreme northwest.—From 1.14 at Saint Vincent, Minnesota, to 1.34 at Fort Stevenson and 1.35 at Bismarck, Dakota.

Upper Mississippi valley.—From 1.09 at Madison, Wisconsin, to 1.54 at Saint Louis, Missouri.

Missouri valley.—From 1.23 at Yankton, Dakota, to 1.52 at Leavenworth, Kansas.

Northern slope.—From 0.83 at Cheyenne, Wyoming, to 1.35 at Fort Assinniboine, and 1.37 at Fort Keogh, Montana.

Middle slope.—From 0.78 at Pike's Peak, Colorado, to 1.10 at West Las Animas, Colorado, and 1.12 at Fort Elliott, Texas.

Southern slope.—From 0.69 at Fort Davis, and 0.93 at Fort Stockton, Texas, to 1.35 at Fort Sill, Indian Territory.

Southern plateau.—From 0.50 at Tucson and 0.51 at Fort Grant, Arizona, to 0.67 at Prescott, Arizona, and 0.85 at Santa Fé, New Mexico.

Middle plateau.—From 0.88 at Pioche, Nevada, to 0.98 at Salt Lake City, Utah.

Northern plateau.—From 0.95 at Eagle Rock, Idaho, to 1.06 at Umatilla, Oregon, and 1.10 at Lewiston, Idaho.

Middle Pacific coast region.—From 0.60 at San Francisco, California, to 0.72 at Red Bluff, California.

Southern Pacific coast region.—From 0.46 at Los Angeles, California, to 0.56 at Visalia, California, and 0.63 at Yuma, Arizona.

AREAS OF HIGH-PRESSURE.

Seven areas of high barometer passed over the region east of the Rocky mountains during the month; two of them first appeared on the Pacific coast. The general direction of movement of these areas was to the southeast, until the area of greatest pressure reached the Atlantic coast, where, in some cases, the direction of the movement changed to the northeast; then it followed the general direction of the coast-line, as the pressure increased to the northward at stations near the Atlantic coast. High-area vii. apparently disappeared within the limits of the stations of observation. This area extended over the Saint Lawrence valley and adjoining districts where the pressure decreased rapidly, unattended by the usual increase of pressure at stations to the eastward of this region.

I.—The 7.00 a. m. weather map of the 1st, exhibited an extended area of high barometer covering the plateau regions, where the pressure ranged from 0.2 to 0.4 above the normal, the greatest pressure being over Nevada and Utah, where the barometer, reduced to sea-level, ranged above 30.5. The movement of this area during the 1st, was directly to the eastward, and, on the morning of the 2d, the pressure had increased to 30.6 on the eastern slope of the Rocky mountains. After passing to the east of the mountains, the course changed and the barometer gradually rose to 30.4, and above in the southwest. The region inclosed by the highest isobar, became elongated in the direction of the Atlantic coast-line, and this area disappeared on the 4th, when the pressure was greatest on the middle Atlantic and New England coasts, thus indicating a general movement slightly to the north of east after the area of greatest pressure passed over the Atlantic.

II.—This area was first observed on the 5th, advancing from the regions north of the Missouri valley, and on the morning of the 6th, snow had fallen at all the northern stations west of Minnesota, attended by temperatures ranging from 5° above to 14° below zero, and by barometric pressures ranging from 30.6 to 30.8 in Montana. At the midnight report of this date, this area became well defined as a cold wave advancing towards the districts east of the Mississippi. At this report the barometer ranged from 30.88 to 30.96 in Nebraska, Dakota, and western parts of Iowa and Minnesota. The barometric gradient was marked to the east and south of the regions above named, and at stations in northern Texas, the temperatures fell from 50° to 60° in less than sixteen hours. On the afternoon of the 6th, the Chief Signal Officer notified the Sugar Growers' Association at New Orleans, and, by special message to the local authorities, all railroads operated in the southwest, that this cold wave was advancing toward that section, and warned them that freezing weather would probably extend as far southward as the Gulf coast. On the afternoon of the 7th, this area was central in eastern Kansas, where the barometer had risen to 30.91 at Leavenworth. Professor F. H. Snow states in his report that the barometer at his station, Lawrence, Kansas, was more than 0.2 higher on that day than it has previously been during the fifteen years of his record. The general telegraphic reports indicated the advance of a barometric depression in the Rocky mountain region, and the gradient was rapid in all directions from the lower Missouri valley. A severe norther occurred on the Gulf coast, the wind reaching a velocity of fifty-nine miles per hour at Indianola, forty-eight miles at Galveston, and forty-three miles at Port Eads, on the 7th. Northwest gales also occurred on the northern lakes attended by snow, which was soon followed by clearing cold weather; the temperature falling to zero as far south as the Ohio valley on the 8th. This area was central near Cairo on the 8th, and by midnight of that date it had passed to the middle Atlantic coast, where the pressure ranged from 30.42 to 30.55, or about 0.4 lower than the barometer was when this area was central in the interior of the continent. During the transit of this cold wave over the United States, the temperature fell below freezing at New Orleans, Pensacola, and Savannah; and killing frosts occurred in Louisiana. When last observed the reports indicated the movement almost directly east from the Atlantic coast.

III.—This area advanced from the north Pacific coast on the 9th, slowly extending over the Rocky mountain region, and moving in a southeasterly direction over Nevada, Utah, Colorado, New Mexico, and Texas; the barometer ranging from 30.3 to 30.4 near the centre. On the morning of the 11th, it extended over the southwest, and from that region it gradually extended over the Southern states during the 12th, attended by clear weather. This area, as in the case of i., extended to the northward after reaching the coast, and the course in this case changed to the northeast, the centre passing along the Atlantic coast until it reached latitude 45° N., where it disappeared to the eastward on the 13th.

IV.—This area appeared in British America north of the upper Missouri valley on the 13th, the region of high barometer extending to the southwestward over the Rocky mountain stations, Utah, Arizona, and California, on the 14th. On the 15th, this cold wave extended from the lake region westward to the Pacific coast, and southward to the latitude of northern Texas, and was attended by the marked changes in tempera-

ture of the month in the southern and eastern sections of the United States. On the morning of the 15th, the barometer had risen to 30.8 in Montana, and the temperature ranged from —4° to —26°; the temperature at Fort Garry, Manitoba, being —33°. The course of this area was southward from Montana, and, by the morning of the 16th, the region of greatest pressure, 30.6, covered the southwestern part of Texas, where the temperature was below freezing. A norther occurred in the Gulf of Mexico on this date, and the frost warnings communicated by this office to the Gulf stations, the sugar regions of Louisiana, and the fruit regions of Florida, were fully verified by the occurrence of freezing weather as far southward as central Florida, They were published in the local papers, communicated direct to telegraph operators in the threatened regions, and the observer at New Orleans reports that they were worth thousands of dollars to the sugar interest of that state. On the morning of the 17th, killing frosts occurred at Port Eads, Louisiana; Galveston, Texas; and Jacksonville and Cedar Keys, Florida. After reaching the lower Rio Grande valley, this area advanced to the eastward over the Gulf of Mexico, attended by clear weather, and north to west winds at the land stations. The course of the centre was south of the coast, and the winds were from the land, thus causing more intense cold at stations near the coast.

V.—This appeared north of the lake region on the 18th, when iv. was passing to the east of Florida. This area extended over the Atlantic coast districts, attended by clear cold weather and frosts, as far south as Georgia on the 19th, when the greatest pressures, ranging from 30.52 to 30.56, were reported in the Saint Lawrence valley. The barometer rose in the districts northeast of New England on the 19th, but the general movement was to the eastward until the morning of the 21st, when the advance of the depression from the lake region caused a gradual fall of the barometer in that region. Reports from the coast stations indicate that this area disappeared in the region above named, and that it did not move eastward over the Atlantic.

VI.—The barometer was 0.2 above the normal on the 22d, and high in the southern plateau region, where the pressure continued high until this area, reinforced by a flow of cold air from the northern Rocky mountain regions on the 23d, was transferred to the upper Missouri valley. At midnight of the 23d, this area extended southwestward to California, Utah, and Arizona, while the barometer was below the normal on the north Pacific coast, and the low-area was forming in Texas. During the 24th, it extended over the northwest and southward to Texas, while a slight depression in the southwest extended northward over Missouri and Iowa, causing light snow north of the Missouri river and rain south of this region. The easterly movement of this area was apparently retarded by the development of the low-area above referred to, and by an increase of pressure from the north Pacific coast united with high-area vi., which, on the 25th, extended from the Saint Lawrence valley to the Pacific, the barometer being above 30.5 in the western districts. The morning report of the 27th placed the centre of this area in Dakota, and the charts show that the entire country from the Atlantic to the Pacific was within its limits. North to west winds prevailed east of the Rocky mountains; light snows were reported from northern Texas to New England, and freezing weather as far south as Mexico. It was well defined on the eastern slope of the Rocky mountains, and thence moved first slightly to the south and then directly eastward over the Ohio valley and the middle Atlantic states, where it became less defined, and apparently gave way to the north of low-area x., which passed northeastward along the south Atlantic coast on the 30th.

VII.—When the preceding area moved to the eastward of the Mississippi river the barometer remained high in the upper Missouri valley, and, on the 30th, the pressure had increased to 30.8 in Dakota and Montana, with the temperature below zero and light snow. The barometric gradient was rapid in a southwesterly direction, and there were indications of the development of a low-area in Arizona. During the 31st, this area moved southward over the region between the Mississippi river and the Rocky mountains, causing freezing weather as far south as San Antonio, Texas. Frosts occurred along the Atlantic coast and in northern Florida, warnings of which had been previously furnished by this office. At the close of the month, this area was inclosed in the region southwest of the lower Missouri valley by an isobar of 30.5, while there was a second area of high-pressure apparently forming in the upper Missouri valley.

AREAS OF LOW-PRESSURE.

Ten areas of low barometer have been traced within the limits of the United States during the month of December, 1882. Chart i. exhibits the paths of the centres of these barometric depressions as determined from tri-daily weather reports of this service. From the following table will be found the latitude and longitude in which each depression was first and last observed, and the average hourly velocity of each depression while within the limits of the stations of observations:

Areas of low barometer.	First Observed.		Last Observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
	° ′	° ′	° ′	°	
No. I.	42 30	91 00	46 00	62 00	34.
II.	50 00	110 00	48 30	77 00	28.7
III.	35 30	97 00	52 00	63 00	48.
IV.	48 00	81 00	50 00	60 00	31.
V.	42 00	98 00	43 00	62 00	27.3
VI.	48 30	124 30	48 00	63 00	26.5
VII.	30 00	97 00	45 00	86 00	22.
	35 00	98 00			
VIII.	27 00	97 00	44 00	62 00	33.5
IX.	37 00	95 00	41 00	83 00	18.5
X.	27 30	93 30	35 00	74 30	33.
Mean hourly velocity					30.2

The following table shows the number of areas of low barometer traced during the month of December, since 1873:

Month.	Year.	Number.	Month.	Year.	Number.
December	1873	12	December	1878	8
Do	1874	12	Do	1879	21
Do	1875	9	Do	1880	15
Do	1876	15	Do	1881	10
Do	1877	15	Do	1882	10

I.—On the morning of the 1st of December, a barometric depression extended over the Saint Lawrence valley from east to west, and the barometric gradient, while it was slight, showed a very gradual increase of pressure as far westward as Nevada. The afternoon report of the 1st, indicated the development of a second storm-area to the west of the lake region, although the pressure was lowest at stations northeast of New England. At the midnight report of the 1st, it exhibited an elliptical area of low-pressure extending from Ontario to Iowa, and central near Chicago. At the morning report of the 2d, the isobar of 29.9 inclosed the lower lake region. The storm increased in energy as it approached the Atlantic coast, and was attended by snow in the northern districts, after the wind shifted to the northwest. When the centre reached the coast, the course changed to the northeast, following the coastline toward Halifax, where the storm was central on the morning of the 3d. The barometer fell as this storm moved to the east, and, when last observed, the barometer was about one-half an inch lower than it was when this cyclonic movement of wind was first noted in the upper Mississippi valley. As the storm approached the Atlantic coast, cautionary off-shore signals were displayed on the middle Atlantic and New England coasts, cautionary northwest signals on the upper lakes, and cautionary signals on the lower lakes and North Carolina coast. This storm was not severe in the lake region, but it developed great energy as it approached the coast. The following maximum wind velocities were reported: Delaware Breakwater, 52 nw.; Cape Henry, 48 nw.; Kittyhawk, 46 ne.; Boston, 28 nw.; Eastport, 32 nw.

II.—This depression was first observed in British America, north of Montana on the 2d, while the barometer was high on the north Pacific coast and in the Mississippi valley. It moved directly east to Manitoba, attended by snow at northwestern stations. Its course changed to southeast on the afternoon of the 3d, and, during the night of the 3d, the centre of disturbance passed south of Lake Superior, causing southeast and southwest gales on Lakes Michigan and Huron. On the morning of the 4th, this storm extended over the entire lake region, the centre being near Escanaba, where the barometer had fallen 29.40, accompanied by brisk easterly winds and snow. At the same reports, the observer at Duluth reported barometer 29.54, wind 27, nw.; at Milwaukee, the observer reported, barometer 29.55, wind 20, sw.; at Mackinac City, 29.67, wind 28, s. The barometric gradient was decided both to the east and south, and the energy increased during the 4th, as the course changed to the north of east. This change of direction carried the centre of disturbance north of the lower lake region, but the storm extended southward to the Ohio valley and the middle states. After passing to the east of Lake Superior, the pressure increased two-tenths of an inch at the centre, during twenty-four hours, and by the morning of the 5th, it had passed north of the stations in the Saint Lawrence valley. Signals were displayed at lake stations, and at stations on the Atlantic coast between Norfolk and Portland, and were generally justified, but the greatest danger to shipping occurred in the upper lake region on the 4th, while this disturbance attained its maximum energy.

III.—When the storm last described was central north of Lake Huron, the barometric depression, then extending over the southwest, became inclosed by an isobar of 29.9, and developed energy by the advance of a cold wave from the mountain regions toward the south. This storm passed rapidly to the northeast, with increasing force and falling barometer at the centre at each succeeding report, until it reached Lake Ontario. The area of precipitation attending this storm included all districts east of the Mississippi, and the cold wave, which followed immediately in the northwest, extended the region of snow westward to the Rocky mountains. This storm passed to the north of the Gulf of Saint Lawrence on the 6th, but was followed by the development of a low-area in the western part of Canada.

IV.—This area apparently formed a part of iii., and developed a separate area during the night of the 6th, central north of the lower lake region, while a cold wave was advancing from the northwest. The barometric gradient increased rapidly in the western quadrants of this storm, and violent northwesterly gales occurred at the lake stations, accompanied by snow and temperatures ranging from 30° above to 10° below zero. This storm moved slowly down the Saint Lawrence valley on the 7th, followed by severe weather and dangerous winds in the south and west quadrants, and disappeared to the east of Newfoundland on the 8th. Warnings were given by this office to stations on the lakes, of the approach of this northwest gale, and off-shore signals were displayed on the Atlantic coast at stations north of Fort Macon. The following velocities of wind were reported during this storm: Delaware Breakwater, 57 nw.; Cape May, 62 nw.; Kittyhawk, 48 nw.; Newport, 43 w.; Portland, Maine, 40 w.; Rochester, 42 w.; Buffalo, 45 W.; Sandusky, 44 w. Reports indicate that this storm developed northeast of the upper lake region, and its great energy was due more to the advance of the cold wave from the northwest, than to the barometric depression at the centre of disturbance.

V.—This depression developed on the middle and eastern slope of the Rocky mountains, and was an extended trough of low barometer, located between two high-areas, one of which was on the Atlantic coast, while the other extended over the north Pacific, the centre of lowest pressure being near Yankton, Dakota. This distribution of pressure continued during the 9th, but the depression increased in energy and had advanced to the upper Mississippi valley as a well-defined low-area, inclosed by isobars of 29.8 and 29.9, by midnight of that day. This storm passed directly east over the lake region during the 10th, causing rain and snow in the Southern states and snow in the northern states. During the night of the 10th, the depression formed two distinct areas, one passing to the south of New England, and the other remaining central in northern New York, on the morning of the 11th. The afternoon report of the 11th, showed that these depressions had united off the New England coast. The course then changed to the northeast, and the centre apparently passed near the coast of Nova Scotia. The pressure at the centre of this depression remained near 29.8 during its passage from the northwest to the New England coast, but after its course changed to the northeast the barometer fell to 29.35 at Halifax, at midnight of the 11th, and to 29.25 at Sydney on the morning of the 12th, when this storm was last observed, thus indicating a great increase of energy as it moved to the northeastward.

VI.—This is the only storm of the month which was first observed on the Pacific coast and traced thence over the eastern part of the United States. It was central on the north Pacific coast on the afternoon of the 10th, and passed directly east, following approximately the fiftieth parallel of latitude until it reached the longitude of Lake Superior on the 12th, when the course inclined slightly to the south until the disturbance reached the Saint Lawrence valley. On the afternoon of the 13th, when the centre was north of the lower lake region, this storm separated, forming two depressions, each of which could be located between the two succeeding reports. These depressions united on the 14th, and moved to the northeast of New England. The storm passed from the Pacific to the Atlantic coast from the 10th to the 14th, and moved eastward over the Atlantic on the same latitude in which it was first observed on the Pacific coast. It increased in energy as it passed over the lake region, the barometer falling to 29.37 when the centre was near Saugeen, Canada. Heavy gales occurred at lake stations on the 13th and on the north Atlantic on the 14th. The pressure decreased at the centre and when last observed, on the 15th, the minimum pressure of 29.18 was reported from extreme northeastern stations.

VII.—This depression formed in the southwest, where the barometer was generally below the normal for the month at the Rocky mountain stations, a second depression passing eastward over the north Pacific coast. The last has not been traced, but passed over British Columbia, and to the east of the Rocky mountains north of Dakota. On the 19th, the barometer was below the mean at all western stations, and, as is indicated by this storm-track, two depressions were noted in the western Gulf states. The succeeding reports show that these depressions united during the 20th and 21st, and passed northward over the upper lake region, the course inclining more to the north as the centre approached the higher latitudes. The greatest rainfalls of the month occurred in the lower Mississippi valley, when this storm was passing northeastward from Indian Territory. On the 20th, rain or snow occurred in all districts east of the Rocky mountains, except in New England. The barometer fell at the centre of this disturbance until it had passed the southern portion of Lake Michigan, where maximum wind velocities occurred. After passing this latitude the pressure increased slowly at the centre, and the reports indicate that the storm was losing energy when it passed beyond the limits of observation.

VIII.—This was a depression of slight energy which appeared south of Texas on the 21st, attended then and on the following day by a light norther in the southwest. It moved to the eastward over the Gulf, probably passing the coast-line near Pensacola on the 22d, after which the depression could not be defined by the usual isobars drawn for every one-tenth of an inch of pressure. This portion of the track has therefore been drawn dotted, as the general circulation of the winds and the weather conditions in the south Atlantic states indicate the presence of a slight disturbance which became quite well defined off the middle Atlantic coast at the 11.00 p. m. report of the 22d. The storm increased in energy after the above

report, and, moving in a northeasterly direction, caused severe gales near Cape Cod and off the New England coast on the 23d. The barometer fell at the northeastern stations on the 24th. The late reports show that the storm developed great energy as it passed over the Atlantic.

IX.—The weather conditions in the western Gulf states attending the development of this storm were somewhat similar to those described as accompanying storm viii. Two slight depressions appeared at midnight of the 24th, one central in southern Missouri, and the other central south of the Texas coast. These depressions united and formed that traced as ix., the barometer remaining low in the southwestern sections of the country. The depression developed but slight energy and finally disappeared in the upper Ohio valley on the 26th, in advance of a cold wave which apparently interrupted the cyclonic movement of winds and caused the formation of a second depression to the eastward of New England.

X.—This appeared in southern Florida, as a slight depression, on the 29th, forming in advance of an area of cold air which was at that time moving slowly southward over the Mississippi valley. This storm was at no time inclosed within the limits of the stations, but the changes in barometric pressure and wind directions show that it moved to the northeast nearly parallel with the Atlantic coast. Severe gales occurred at Kittyhawk, Hatteras, and Cape Henry, accompanied by very heavy rainfall. The following maximum wind velocities were reported: Kittyhawk, 66 ne.; Cape Henry, 48 n.

NORTH ATLANTIC STORMS DURING DECEMBER, 1882.

Chart supplemental to number i., exhibits the tracks of the principal storms that have prevailed over the north Atlantic ocean during December, 1882. The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels in the north Atlantic, and from other miscellaneous data received at this office up to January 20th.

The observations used are, in general, simultaneous, being taken each day at 7 h. 0 m. a. m., Washington, or 12 h. 8 m. p. m., Greenwich mean time.

The following brief notes concern the storms above mentioned:

I.—This is a continuation of the storm charted as low-area i., chart i. On the morning of the 3d, the depression was central south of Nova Scotia; it moved rapidly northeastward near to the coast-line, and probably crossed the southern extremity of Newfoundland. On the 4th, it was central near the Banks, attended by severe gales on the coast of Newfoundland. On the 5th, the storm-centre was apparently near W. 35°, and between N. 50° and 55°; on that date, the s. s. "British Crown," in N. 53° 35′, W. 35° 42′, reported barometer 29.43 (747.5), wind nnw., force 8, weather squally, with rain. On the 6th, the centre of disturbance was shown near N. 50°, W. 20°, the s. s. "Wyoming," in N. 51° 13′, W. 17° 21′, reporting barometer 29.69 (754.1), wind e. by n., force 5; and the s. s. "Frisia," in N. 49° 52′, W. 22° 50′, barometer 29.69 (754.1), wind nne., force 7, squally weather. During the 6th, the disturbance moved eastward, and on the 7th, it was probably central near the British Isles. This depression appears to have moved very rapidly eastward, its average velocity of translation being about thirty-seven miles per hour; it was also closely followed by an immediate increase of pressure in its rear.

II.—This is probably a continuation of the depression traced as low-area iv., of chart i. On the 8th, the storm-centre was over the Gulf of Saint Lawrence; strong south-southeasterly gales were reported by vessels near the Banks of Newfoundland, while equally strong westerly winds were encountered near Nova Scotia. Captain W. H. P. Hains, of the s. s. "Gallia," (in about N. 41°, W. 62°), reported: 8th, at 2 h. 30 m., a. m., Greenwich mean time, violent storm, wind shifting from s. to wnw., with violent squalls, and torrents of rain; heavy thunder, vivid sheet and forked lightning; confused sea; the fury of the storm lasted about three hours, lowest barometer 29.65 (753.1). On the 9th, the depression was apparently central near N. 49°, W. 42°; the s. s. "Frisia," in N. 46° 52′, W. 42° 55′, reported barometer 29.87 (758.7), a fall of .33 inch, wind wnw., force 6–8, cloudy and rainy weather; the s. s. "Gellert," in N. 49° 36′, W. 33° 15′, barometer 29.92 (760.0), wind ese., force 6, cloudy. During the day, the disturbance apparently moved in a northeasterly direction, and on the morning of the 10th, was central near N. 51°, W. 35°; on that date, the s. s. "Colima," in N. 53° 17′, W. 31° 53′, reported barometer 29.68 (753.9), a fall of .26 inch in twenty-four hours, wind se. by s., force 5, sleeting; s. s. "Arizona," in N. 50° 54′, W. 35° 14′, barometer 29.83 (757.7), wind variable, weather overcast and cloudy. On the 11th, the depression appears to have moved in a course slightly to the south of east, the region of least pressure, on that day, being apparently south of N. 50°, and near W. 25°; the s. s. "Arizona," in N. 51° 10′, W. 24° 56′, reported barometer 29.72 (754.9), wind e., force 4, overcast; and the s. s. "Nederland," in N. 49° 52′, W. 21° 32′, barometer 29.82 (757.4), wind ne., force 6, drizzling. Strong westerly and northwesterly gales were reported by vessels south and west of the centre of disturbance; the ship "E. J. Spicer," in N. 45° 32′, W. 29° 40′, reporting barometer 29.83 (756.7), wind w., force 8, squally. On the morning of the 12th, the depression was central, with decreased pressure near the entrance to the English Channel, and moderate northerly and northeasterly gales prevailed over that region. The s. s. "Arizona," in N. 51° 32′, W. 15° 58′, reported barometer 29.59 (751.6), wind n., force 3; s. s. "Gellert," in N. 50° 05′, W. 10° 00′, barometer 29.50 (749.3), wind ne., force 6, squally; s. s. "Switzerland," in N. 50° 47′, W. 16° 39′, barometer 29.64 (752.8) wind n. by e., force 5.

III.—This is a continuation of the depression traced on chart i. as low-area v. During the 11th, the disturbance passed off the New England coast into the Atlantic attended by strong westerly and southwesterly winds near the coast. On the morning of the 12th, the depression was apparently central south of Newfoundland; on that day the atmospheric pressure greatly decreased and the barometer fell to 28.90 (734.0). From reports at hand, it would appear that this was the most severe storm of the month; several vessels were wrecked, involving serious loss of life, on the coasts of Newfoundland and Nova Scotia, and much property was destroyed in the harbors. During this gale, the Inman steamship "City of Berlin" lost her rudder and rudder-post, and returned to New York in tow of the s. s. "City of Chester." The s. s. "City of Berlin," in N. 43°, W. 57°, reported: On the 12th, had a severe gale from sw., barometer fell to 28.93 (734.8), at 6 a. m., after which time it began to rise; at 7 a. m. the reading was 29.01 (736.8), wind w., force 9, sleet and misty; the sea was very high and dangerous and the vessel was hove to. The s. s. "Nova Scotian," in N. 47° 52′, W. 50° 15′, reported barometer 29.11 (739.4), wind se., force 4, raining; the s. s. "Celtic," in N. 44° 58′, W. 52° 44′, reported barometer 29.13 (739.9), wind wsw., force 8, cloudy; all vessels between N. 40° and 45° and west of the fiftieth meridian encountered westerly and northwesterly winds of force 7 to 10. Captain Hebich, of the s. s. "Wieland," reported as follows: "During the 10th and 11th, had moderate breeze and sea. On the 12th, (N. 46° 21′, W. 46° 57′), the wind increased to a gale, with very high, wild, and cross-running sea; the gale began at ese., and shifted during the forenoon to s. During the night of the 12th–13th, the wind shifted to sw., with heavy rain; the ship took breakers fore and aft, and the deck was covered with water, At the beginning of the gale, the barometer read 30.01 (762.2), and gradually fell to 29.13 (739.9), on the night of December 12th." During the 12th, the disturbance moved northeastward, and on the 13th, the storm-centre was apparently near N. 50°, W. 45°. The s. s. "Nova Scotian," in N. 50° 27′, W. 45° 15′, reported barometer 28.41 (721.6), wind sw. by s., force 5, high confused sea, raining; s. s. "Colima," in N. 49° 20′, W. 43°

05′, barometer 28.85 (732.8), wind wsw., force 10. On the 14th, the disturbance, having moved slowly eastward, was central near N. 51°, W. 40°; moderate winds prevailed near the centre, while strong westerly gales prevailed over the region to the westward of the fortieth meridian. The s. s. "Alaska," on the 13th and 14th, from N. 48° 14′, W. 39° 38′, to N. 47° 25′, W. 42° 38′, encountered very heavy westerly gales, with mountainous seas; during these twenty-four hours, the vessel steamed only one hundred and thirty miles. The s. s. "Nova Scotian," on the 14th, in N. 51° 53′, W. 39° 19′, reported barometer 28.84 (732.5), wind ene., force 4, showery; and the s. s. "State of Georgia," in N. 51° 01′, W. 38° 12′, barometer 28.91 (734.3), wind sse., force 1, heavy sw. sea; the s. s. "Bothnia," in N. 48° 21′, W. 39° 08′, reported barometer 29.17 (740.9), heavy westerly gale, accompanied by hail, rain, and very heavy squalls, heavy westerly sea. On the 15th, the storm-centre was near W. 30°; the pressure had slightly increased and the storm apparently diminished in energy. The s. s. "Elbe," in N. 49° 40′, W. 26° 23′, reported barometer 29.22 (742.2), wind sw., force 2, cloudy; s. s. "Werra," in N. 50° 12′, W. 30° 25′, barometer 29.39 (746.5), wind n., force 2–3. During the 15th, the disturbance moved northeastward, and on the 16th, it was central probably near the northwestern coast of Ireland. The s. s. "Ethiopia," in N. 54° 42′, W. 13° 59′, on the 16th, reported barometer 29.29 (744.0), wind ese., force 4, overcast and rainy, and the s. s. "Baltic," in N. 57° 32′, W. 14° 36′, barometer 29.33 (745.0), wind nw., force 6.

IV.—This is probably a continuation of the storm traced as low-area vi., chart i. At midnight of the 14th, the depression was central over the Gulf of Saint Lawrence, and during that day strong southeasterly gales prevailed over Newfoundland and to the south of Nova Scotia, and numerous marine disasters were reported. On the 15th, the centre of disturbance was to the eastward of Newfoundland, and probably united with the remains of low-area iii. On the 16th, the depression was central near N. 52°, W. 40°; the s. s. "Werra" in N. 48° 32′, W. 39° 00′, reported barometer, 29.25 (742.9), wind wsw., force 7–8, cloudy and rainy weather, and the s. s. "Elysia", in N. 47° 28′, W. 34° 34′, barometer 29.61 (752.1), wind sw., force 5. The depression passed northeastward, being succeeded by strong northwesterly winds and clearing weather in the western quadrants, and on the 17th, it was central near N. 54°, W. 25°; on that date, the s. s. "Nova Scotian," in N. 55° 02′, W. 20° 07′, reported barometer 29.04 (737.6), wind sse., force 3, cloudy. The s. s. "Ohio", in N. 51° 09′, W. 20° 30′, reported barometer 29.13 (739.9), wind w., force 5, fair; while vessels to the eastward of the twentieth meridian encountered strong southerly gales. On the 18th, the depression was off the Irish coast, accompanied by moderated easterly and northeasterly gales in the region north and east of the centre, while brisk northerly and northwesterly winds prevailed in the rear of the depression. From the 20th, to the close of the month, a large and deep depression covered the north Atlantic ocean from Newfoundland eastward to the British Isles. In this extended area, the atmospheric pressure ranged from 28.50 (723.9) to 29.80 (756.9), and from the circulation of winds, it would appear that two or more independent storm-centres were enclosed within its limits; the data on hand at this moment, however, are too meagre to admit of a tracing of the paths of these storms. It is worthy of note, that, notwithstanding the depth of the atmospheric depression, extremely violent winds do not appear to have been general, many vessels reporting light to moderate winds. The following reports serve to indicate the weather conditions over the north Atlantic during the last decade of the month: Captain Molsen of the s. s. "Heckla," reported: "From the 20th, to 26th, between N. 56° 30′, W. 25° 10′, and N. 45° 30′, W. 53° 00′, barometer oscillating irregularly between 29.47 (748.5) and 30.20 (767.0); wind very unsteady in direction and force; weather threatening with clearing at intervals." Captain Hamilton Perry, of the s. s. "Britannic," reported: "December 23d, in N. 51° 21′, W. 14° 22′, light westerly breeze with heavy rain, barometer 29.98 (761.5) moderate sea from wsw., barometer falling slowly but steadily until 4 a. m., of the 26th, (about N. 49° 24′, W. 38° 15′), when it read 28.85 (732.8). During this interval, the wind had been variable in direction, and from strong to gentle breeze with heavy swell from the sw. After the 26th, the barometer rose steadily, the wind veered to ne. and n., with heavy squalls and showers of rain, and with heavy northeasterly swell. At no time did we have the wind to warrant such a low glass."

Captain J. T. Rogers, of the s. s. "Lepanto," reported: "December 20th, 2.30 p. m. (near N. 44°, W. 37°), strong southerly gale with hard squalls of rain; dull cloudy weather and high mountainous sea; moderating at midnight of 20th. 21st, moderate southeasterly gale, much rain and very heavy swell from south; weather at times clearing, and then heavy squalls of rain would appear on the horizon. This fitful weather continued until the morning of the 22d; at 8.40 a. m., Greenwich mean time, it became overcast, the wind increased and lulled until 9.40 a. m., when it blew a hurricane, accompanied by heavy rain. At 4.00 a. m., the barometer read 29.76 (755.9), and at 8.40 a. m., it stood at 29.07 (738.4); the hurricane lasted two hours, and then decreased to a very strong gale. On the 25th, at 8.00 a. m. (N. 42°, W. 54°), had a strong northwesterly gale and high sea; terrific squalls of wind and rain till noon of the 26th, when it moderated."

Captain W. C. Gardner, of the bark "Champion," reports: "23d, 3.30 p. m., Greenwich mean time, N. 32° 05′, W. 74° 07′, with lowering overcast sky, it began to rain heavily, accompanied by thunder and lightning, wind falling light. The electrical disturbance continued until 6.30 p. m., when it ceased, the rain continuing (but lighter) until 10.00 p. m., wind, light airs."

Captain Brooks, of the s. s. "Arizona," reports: "26th, (N. 51° 07′, W. 27° 29′), at 5.50 p. m., Greenwich mean time, the barometer fell to 28.70 (729.0), wind wsw., force 10 to 12, with constant rain; the barometer then rose slowly, and the wind gradually decreased. This gale ended at wsw. We nearly always find gales of this nature shifting suddenly to the northward."

Captain H. C. Williams, of the s. s. "Brooklyn," reports: "25th, at 21h. 29m. (near N. 52°, W. 33°), lowest reading of the barometer 28.50 (723.9); depression evidently very extensive, and the gradient of a moderate inclination, as it passed without any atmospheric disturbance corresponding with the low state of the barometer."

Captain E. E. Wilson, of the s. s. "Salerno," reported: "From 29th to 31st, between N. 49°, W. 17°, and N. 49°, W. 27°, barometer rising gradually until 8.00 p. m. of the 29th, when it fell to 29.10 (739.1), wind backed to southeast, blowing strongly, with fine clear weather and heavy cross-sea, which continued until 4.00 a. m. of the 30th. The wind then shifted to westerly, and continued to blow hard; weather clear. At 6.00 a. m. of the 31st, the barometer again fell to 29.27 (743.4), weather cloudy with rain, fresh breeze from e., sw., w., and nw.

INTERNATIONAL METEOROLOGY.

International charts iv. and v. accompany the present number of this REVIEW. Chart iv. is published for October, 1880, and continues the series begun in January, 1877. Chart v. is prepared for January, 1881, and continues the series begun in November, 1877. For the description of these charts, much valuable information has been obtained from the "Monatliche Uebersicht der Witterung," published by Professor Dr. G. Neumayer, Director of the German Marine Observatory at Hamburg, and from the "Bulletin Mensuel," published by Mr. Marc Dechrevens, of Zi-Ka-Wei, China.

Chart iv. exhibits the mean pressure, mean temperature, and the prevailing directions of the wind over the northern hemisphere, and at certain isolated stations in the southern hemisphere, as determined from one observation taken each day at 7.35 a. m. Washington, or 0.43 p. m. Greenwich mean time.

The region of lowest mean pressure, indicated by the isobar of 29.60 (751.8), occupied that part of European Russia lying

north of the sixtieth parallel of latitude, and between the meridians of 30° and 50° east longitude. Within this area, the lowest mean pressure reported was 29.52 (749.8) at Archangel. South of 60° N., the barometric gradient gradually increases until the isobar of 30.00 (762.0) occupies southern Russia and central Asia.

The isobarometric lines of 29.70 (754.4) and 29.80 (756.9) cover central and western Russia, the Scandinavian peninsula, and western Siberia, while that of 29.90 (759.4) occupies the countries of central and western Europe.

In the North American continent, the area of barometric minima occupies the region near Hudson's Bay; here the lowest mean pressure reported, 29.89 (759.2), was at York Factory, British America.

In the eastern hemisphere, the area of highest mean pressures occupies southeastern Siberia and China; and the isobar of 30.10 (764.5) covers the central and southern parts of Algeria and Tunis, where the mean pressure ranges from 30.10 (764.5) to 30.16 (766.1).

In the United States, the area of highest mean pressures covers the north Pacific coast region, where the mean pressure ranges from 30.15 (765.8), at Olympia, Washington Territory, to 30.33 (770.4) at Umatilla, Oregon. The isobarometric line of 30.10 (764.5) occupies Texas, the Southern and middle states, and extends to the southern part of the New England states.

Compared with the preceding month, (September, 1880,) there has been a general increase of pressure over the United States; the increase is most marked in the north Pacific coast region. The isobar of 30.10 (764.5), which, in September, occupied the Southern states, has extended northeastward to the forty-fifth parallel.

In Canada, the mean pressure has increased in all parts of the Dominion, the increase being greatest over the Maritime Provinces.

In Europe, the mean atmospheric pressure has everywhere decreased, the decrease being greatest in northern Russia, where it amounted to .50 inch. In the northern part of Scotland and in Ireland, there has been a slight increase in pressure.

In Greenland, the pressure has greatly increased, the mean at Godthaab being 30.07 (763.8), or .25 inch above that of the preceding month.

In Algeria and Tunis, a very slight increase has occurred in the mean pressure.

In Asia, the pressure has increased over Hindostan and over the eastern part of the continent.

Compared with the corresponding month of previous years, the mean atmospheric pressure is slightly above the normal in all parts of the United States. In Washington Territory, it is about .07 inch above the normal.

In Canada, the mean pressure generally is above the average.

The following table shows the mean pressure and the mean temperature, with corresponding departures, for the month of October, 1880, in the several countries of Europe and Asia, compared with the means as determined from observations taken during the years 1877, 1878, and 1879:

Countries.	Mean Pressure.			Mean Temperature.		
	Oct., 1877, 1878, and 1879	Oct., 1880.	Departure.	Oct., 1877, 1878, and 1879.	Oct., 1880.	Departure.
				°	°	°
Algeria	30.07	30.11	+0.04	69.3	75.8	*+ 6.5
Austria	30.02	29.92	−0.10	58.3	56.8	− 1.5
British Isles	29.91	29.90	−0.01	53.7	50.1	− 3.6
Denmark	29.87	29.78	−0.09	50.7	46.1	− 4.6
France	30.02	29.93	−0.09	64.6	64.3	− 0.3
Germany	30.00	29.85	−0.15	52.5	50.1	− 2.4
India	29.84	29.86	+0.02	80.6	80.8	+ 0.2
Italy	30.02	29.97	−0.05	65.4	66.9	+ 1.5
Norway	29.72	29.74	+0.02	46.7	40.4	− 6.3
Portugal	30.07	30.00	−0.07	67.7	67.9	+ 0.2
Russia	30.01	29.81	−0.20	51.4	46.5	− 4.9
Spain	30.00*	29.97	−0.03	67.7*	68.2	+ 0.5
Sweden	29.76	29.66	−0.10	44.1	35.2	− 8.9

* Mean for two years only.

The accompanying table shows the deviations in pressure and temperature at isolated stations during the month of October, 1880, as compared with the means of three years:

Comparative Thermometric and Barometric Means, with corresponding Departures.

Station.	Mean Pressure.			Mean Temperature.		
	Oct., 1877–78–79.	Oct 1880.	Departure.	Oct., 1877–78–79.	Oct., 1880.	Departure.
				°	°	°
San José, Costa Rica, C. A.	.....	.....	.....	67.5	66.9	− 0.6
Gibraltar	30.03	30.06	+0.03	*69.9	69.6	− 0.3
Malta, Mediterranean Sea	30.00	29.99	−0.01	73.2	74.6	+ 1.4
Sandwick Manse, Orkney Islands	29.77	29.96	+0.19	49.1	44.6	− 4.5
Bridgetown, Barbadoes	29.92	29.96	+0.04	82.9	80.8	− 2.1
Cape Town, Cape Good Hope	30.04	30.09	+0.05	68.0	80.2	+12.2
Fort Napier, Natal, South Africa	29.86	29.91	+0.05	72.2	70.5	− 1.7
Freetown, Sierra Leone	29.93	29.89	−0.04	84.0	84.0	normal
Mauritius, Indian Ocean	30.10	30.15	+0.05	74.9	75.0	+ 0.1
Melbourne, New South Wales	30.00	29.94	−0.06	54.6	55.8	+ 1.2
Nassau, Bahamas	29.99	30.00	+0.01	80.0	79.4	− 0.6
Godthaab, Greenland	29.68	30.07	+0.39	29.9	37.2	+ 7.3
Stykkisholm, Iceland	29.64	30.17	+0.53	38.4	37.4	− 1.0
Thorshavn, Faroe Islands	29.60	30.01	+0.41	46.0	41.0	− 5.0
Fort-de-France, Martinique	29.89	30.11	+0.22	80.8	77.0	− 3.8
Zi-Ka-Wei, China	30.18	30.15	−0.03	58.8	61.9	+ 3.1
Athens, Greece	30.03	30.01	−0.02	71.2	74.5	+ 3.3
Lahore, British India	29.83	29.83	normal	81.8	82.9	+ 1.1
Cagliari, Sardinia, Italy	29.98	29.96	−0.02	70.5	73.9	+ 3.4
Tokei, Japan	30.08	30.07	−0.01	57.3	59.1	+ 1.8
Tromsoe, Norway	29.58	29.61	+0.03	37.3	31.3	− 6.0
Angra, Azores	30.11	29.83	−0.28	66.9	66.6	− 0.3
Funchal, Madeira Islands	30.10	30.05	−0.05	73.3	73.6	+ 0.3
Ponta Delgado, Azores	30.13	29.83	−0.30	70.2	68.4	− 1.8
Archangel, Russia	29.76	29.52	−0.24	39.4	38.3	− 1.1
Tiflis, Russia	30.11	30.02	−0.09	65.8	71.1	+ 5.3
Astrakhan, Russia	30.18	30.01	−0.17	58.0	59.2	+ 1.2
Ekaterinburg, Russia	30.08	29.73	−0.35	41.4	32.7	− 8.7
Nukuss, Toorkistan, Asia	30.19	30.08	−0.11	58.2	66.6	+ 8.4
Tashkend, Toorkistan, Asia	30.27	30.13	−0.14	54.3	55.9	+ 1.6
Barnaul, Siberia, Asia	30.22	30.05	−0.17	39.3	40.6	+ 1.3
Pekin, China	30.18	30.13	−0.05	51.6	55.2	− 3.6
Nikolaievsk on the Amoor, Asia	.....	.....	.....	33.9	29.5	− 4.4
San Juan de Puerto Rico, W. I.	29.93	30.00	+0.07	81.5	81.9	+ 0.4
Mexico, Mexico	29.98	29.98	+0.05	79.7	78.6	− 1.1
Beirut, Turkey in Asia	30.16	30.45	+0.29	54.3	50.9	− 3.4
Havana, Cuba, W. I.	29.93	30.07	+0.14	79.2	78.3	− 0.9
Paramaribo, D. Guiana, S. A.	29.99	30.00	+0.01	81.2	81.4	+ 0.2
York Factory, B. A.	29.98	29.89	−0.09	23.4	21.3	− 2.1

* Mean for two years only.

In the United States, the mean temperature of the air was about normal in the region lying east of the Mississippi river, and south of the forty-first parallel of latitude. Between the Mississippi river and the Rocky mountains, the mean temperature was generally below the normal, the departures ranging from 1° to 4°.

In Canada, the mean temperature was about normal in the Saint Lawrence valley and in the Maritime Provinces; elsewhere it was about 2° below the average.

In Europe, the mean temperature of the air was below the normal in the British Isles, central Europe, the Scandinavian peninsula, and in northern and central Russia. In the southern part of Europe, the temperature was about normal. Refering to the unusually low mean temperature of the month, Mr. James Glaisher, F. R. S., in the "Quarterly Journal of the Meteorological Society," for the quarter ending December, 31, 1880, states that the mean temperature of the air, for October, in England, was below the average of the preceding one hundred and nine years. During that period there were but seven instances of a mean temperature so low for October; viz.: in the years 1778, 1782, 1784, 1786, 1808, 1817, and 1842.

In British India, the temperature was about normal; the the highest mean 85°.0 Fahr. (29°.4 Cent.) was reported at Kurrachee; and the lowest, 73°.6 Fahr. (23°.1 Cent.) at Belgaum.

The following are some of the extreme monthly mean temperatures reported at isolated stations:

Highest.	Degrees.	Lowest.	Degrees.
	°		°
Freetown, Africa	84.0	York Factory, British America	21.3
San Juan de Puerto Rico, W. I.	81.9	Nertchinsk, Siberia	21.6
Saint Thomas, West Indies	81.8	Yeniesisk, northwestern Siberia	24.8
Manila, Luzon, Philippine Isl'ds.	81.5	Nikolaievsk, on the Amoor, Asia.	29.5
		Tromsoe, Norway	31.3

In the United States, the prevailing direction of the wind was northeasterly in Florida, and in that part of the country lying east of the ninetieth meridian, and between 30° and 40° north latitude. North of the fortieth parallel, the prevailing directions were southerly and northwesterly. On the north

Pacific coast, the prevailing wind was northerly, and in southern California they were southeasterly and southwesterly.

In Canada, the prevailing wind was southwesterly.

In Europe, the winds were as follows: Northerly and northeasterly in Scandinavia and the British Isles; westerly in Denmark; in central and western Europe, mostly westerly and southwesterly. In Russia, the prevailing winds were, southerly in the Crimea, westerly and southerly in central Russia, and easterly in the northern part of the country.

In Japan, the winds were mostly northerly. At Zi-Ka-Wei, China, it was easterly.

Over the north Atlantic ocean, the prevailing winds were: northerly and northwesterly, east of 70° west longitude; between W. 50° and W. 30°, and north of the fortieth parallel, they were generally northeasterly; and east of W. 30°, they were easterly and northeasterly.

The rainfall of the month was above the average in the United States, east of the Mississippi river, and south of N. 45°. Between the ninety-eighth meridian and the Mississippi river, it was slightly below the average; and on the Pacific coast, it was also under the average.

In Canada, the rainfall was above the average, except in the Maritime Provinces, where it was much below the average.

In Europe, the rainfall was everywhere considerably in excess of the average. The month is reported to have been one of the wettest Octobers on record; the rainfall in many places being exceptionally heavy. In central and western Europe, the rainfall was more than double the average amount.

Chart v. exhibits the paths of barometric minima for the month of January, 1881, which have been traced from the daily international charts.

The data are charted for each day of the month, on the maps accompanying each issue of the "International Bulletin," and from these charts, and from additional reports are traced the movements of the centres of barometric minima. Thirty-two of the more important depressions that have appeared over the northern hemisphere have thus been traced. The following concerns the general distribution of these depressions:

Eleven appeared in the United States and Canada; three of these were first observed on the Pacific coast, and three apparently developed south of the thirtieth parallel of latitude. Three depressions are traced from the North American continent eastward over the Atlantic; of these, the storm traced as low-area i., was remarkable for the persistency with which it remained over the ocean, the large area under its influence, and the severe gales that accompanied it during the first half of the month.

Fourteen depressions are shown over Europe, and are distributed as follows: Five appeared in the extreme northern part of the continent; the course of those depressions, though somewhat erratic, was, in general, from northwest to southeast. Three depressions traversed central Europe, the most noteworthy being that charted as low-area xxi. It was accompanied by violent snow in England, France, and Germany, and is reported to have been the most severe storm experienced in England during a period of more than fifty years. Two depressions passed northeastward to the north and west of the British Isles, while four appeared in southern Europe, and moved from west to east or northeast.

Six areas of low barometer are exhibited over eastern Asia; these prevailed mostly over Japan, where the barometer was relatively low throughout the month.

The following are brief descriptions of the storms that appeared in the United States and Canada:

I.—This depression developed in the Gulf of Mexico during the night of December 31st. On the morning of January 1st, it was central west of Punta Rassa, Florida, and was attended by light snow in southern Alabama and in northwestern Florida. The centre of disturbance moved across Florida during the 1st, and was accompanied by heavy rains in the peninsula, while heavy northeasterly gales prevailed along the Atlantic coast south of North Carolina. On the 2d, the disturbance was central, with increased energy, near N. 37°, W. 70°, the schooner "Estelle," in N. 37° 24′, W. 74° 37′, reporting hurricane-like winds veering to nw., and lasting four hours; vessel lost mainmast, stove bulwarks, and sustained other damage. On the 3d, the storm-centre was near the Banks of Newfoundland; the s. s. "Ohio," in N. 44° 58′, W. 51° 55′, reported barometer 29.81 (757.2), calm, weather cloudy; vessels west of the centre of disturbance encountered strong n. and nnw. gales. On the 4th, the disturbance moved northeastward, and was central near N. 48°, W. 42°, the pressure decreasing as the centre moved slowly eastward, and strong se. to n. gales prevailed. On the 5th, the area of lowest pressure, indicated by the isobar of 28.80, (731.5), occupied the ocean near N. 47°, W. 37°; the s. s. "Ohio," in N. 48° 48′, W. 40° 09′, reported barometer 28.65 (727.2), wind e., force 7, heavy rain; and the bark "Siddartha," in N. 47° 12′, W. 34° 52′, had a severe se. gale, with very dangerous sea, barometer 28.00 (711.2). During the 6th, the disturbance remained nearly stationary, but the region of least pressure was farther to the westward than on the previous day; the s. s. "Ethiopia," in N. 47° 19′, W. 43° 41′, reported barometer 28.98 (736.1), wind w., force 7, squally; s. s. "Ohio," in N. 50° 13′, W. 36° 49′, barometer 29.01 (736.8), wind se., force 7, heavy rain. On the 7th, the centre moved slowly eastward and was shown near N. 48°, W. 38°. The following vessel reports indicate its position: s. s. "Britannic," in N. 45° 59′, W. 37° 33′, barometer 29.06 (738.1), wind sse., force 5, raining; s. s. "Ethiopia," in N. 48° 42′, W. 38° 01′, barometer 29.07 (738.4), wind e., force 4, cloudy. The s. s. "Ohio," which had apparently moved eastward near to and with the storm-centre, from the 3d to the 6th, appears to have passed beyond it on 7th, as, in N. 50° 51′, W. 32° 19′, she reported barometer 29.49 (749.0), wind se., force 6, cloudy. On the 8th, the area of least pressure extended from the Banks of Newfoundland southeastward to the Azores. Strong westerly and northwesterly gales prevailed at the western limits of this area, and at its northeastern edge, the winds were easterly and southeasterly, varying from fresh to strong gales, with high southwesterly sea. On the 9th, the storm-centre was probably near N. 45°, W. 35°; the s. s. "Celtic," in N. 48° 29′, W. 40° 30′, reported barometer 28.84 (732.5), wind ne., force 2, cloudy. The bark "Wm. Gordon," in N. 50° 00°, W. 28° 40′, had strong se. gale, with high sea, and the s. s. "Oder," in N. 51°, W. 26°, strong sse. gale, high sea and cloudy weather. During the 9th and 10th, the area of the disturbance greatly increased in dimensions and the region of decreasing pressure included Portugal and the western part of Spain within its limits. On the 10th and 11th, the storm-centre was in the vicinity of the Azores, the lowest reported pressure being at Angra, on the 10th, when the barometer read 28.91 (734.3), wind west, 19 miles an hour; and rainy or cloudy weather prevailed at stations in Spain and Portugal. By the morning of the 12th, the shifting of the winds at stations in the Azores indicated that the centre of disturbance had moved to south of those islands. The bark "Coppername," in N. 34° 30′, W. 22° 06′, reported barometer 29.48 (748.8), being a fall of .08 inch, wind changing from sw., force 5, to ssw., force 7. On the morning of the 13th, the storm-centre occupied nearly the same position as on the previous day, but a slight easterly movement appears to have set in during the day, as, on the 14th, the depression presented the form of an extended trough, and the region of least pressure was transferred to northwestern Spain. This disturbance is hereafter described as low area xix. of the chart.

II.—This depression probably developed in the Saskatchewan valley on the last day of the preceding month; it moved southeastward, and on the morning of the 1st, was central in Dakota. The disturbance then moved by an east-northeasterly course toward the lake region, and on the morning of the 2d, the centre was in Ontario, Canada. On the 3d, the depression, having moved down the valley of the Saint Lawrence, was central near the mouth of the Saint Lawrence river, and strong westerly winds occurred at stations

in the Canadian Maritime Provinces. During the passage of the disturbance, a slight rise in temperature occurred in the lake region and in the Saint Lawrence valley; this was immediately followed by a decided fall, the thermometer at many places in northern Ontario, and in the province of Quebec, registering twenty degrees below zero. The disturbance probably moved southeastward during the 3d, and became merged in low-area i., then central near the Banks of Newfoundland.

III.—This depression developed in the Gulf of Mexico, and was central south of Galveston on the morning of the 3d. The disturbance moved northeastward, attended by heavy rain, and was central in southern Mississippi on the 4th; the pressure gradually decreased as the centre moved northeastward, and rain or snow fell in all districts east of the Mississippi river. By the morning of the 6th, the depression was in the lake region, the barometer near the centre reading 29.52 (749.8), at Buffalo, New York. During the 6th and 7th, the disturbance moved northeastward over the Canadian Maritime Provinces and the Gulf of Saint Lawrence, and probably merged in the large depression, low area i., which occupied the north Atlantic ocean on the 7th.

IV.—This storm developed in Manitoba, British America, on the 4th; it moved southward, causing rain and snow in Dakota, Montana, and Nebraska. On the 5th, the storm-centre was in Nebraska; Omaha barometer 29.52 (749.8), and on the 6th, the depression apparently filled up in northern Texas.

V.—From the 4th to the 7th, an area of low-pressure occupied the region near Hudson's bay. On the latter date it was succeeded by an area of high barometer, which prevailed until the 12th.

VI.—This disturbance developed over the western part of the Gulf of Mexico, and on the morning of the 9th, was central south of Galveston. Strong northerly and northeasterly gales were reported at stations on the Texas coast, and heavy rains occurred in Florida and in the states adjoining the Gulf of Mexico. The depression passed rapidly northeastward through Georgia, the Carolinas, and Virginia, and on the 10th, it was off the coast of New Jersey. Severe northerly and northeasterly gales, and heavy rain occurred at stations near the track of the centre, and were followed by strong northwesterly winds and heavy snow, from Texas northeastward to the New England states. On the 11th, the centre of disturbance was south of Nova Scotia, the s. s. "Wyoming," in N. 41°, W. 67°, reporting fresh s. to nw. gale, with rain. During the 12th and 13th, the depression moved eastward and united with low-area i. which, on the last-mentioned date, extended from the Azores to the Banks of Newfoundland.

VII.—This depression, probably an offshoot of low-area viii., appeared in Montana on the 11th, and was attended by heavy snow in that territory and in Idaho. By a course slightly south of east, the disturbance moved to Missouri, where it was central on the morning of the 12th. On the 13th, the depression extended from Texas northeastward to Ontario, Canada, the region of least pressure being in Michigan. During the 13th, the disturbance moved in an east-northeasterly direction across lakes Huron and Ontario, and, on the 14th, entered the province of Quebec, causing rain and snow along the Saint Lawrence valley. The course then became southeasterly, and the disturbance moved over the Maritime Provinces; on the 15th, the centre was east of Nova Scotia, the pressure gradually increasing. On the 16th, the depression disappeared near Newfoundland. During the existence of this depression, the temperature fluctuations were very rapid and marked; an area of high-pressure followed in the immediate rear of the disturbance, and strong northwesterly gales and low temperatures occurred at all stations after the passage of the centre.

VIII.—This depression appeared off the coast of Washington Territory on the 11th. By the 12th, the disturbance had moved to the east of the coast-line, and, on the 13th, finally disappeared in British America. During the existence of this depression, cloudy and rainy weather prevailed generally in the north Pacific coast region.

IX.—This disturbance appeared on the 14th as a well-defined area of low barometer in northern California. It apparently moved southeastward, and, on the morning of the 15th, the region of least pressure was in Kansas. Cloudy weather and light snow prevailed at stations in the eastern quadrants, and light rains fell in southern California. The depression moved slowly southeastward with decreasing pressure, and, on the morning of the 16th, it was shown in eastern Texas; during the day, it moved southward, and, on the 17th, was apparently central near the western shores of the Gulf of Mexico. The course then changed to northeast, and the depression moved slowly over the Gulf. On the 19th, the storm-centre was south of New Orleans, Louisiana, attended by heavy rain, which extended to all the Southern states as the centre of disturbance moved northeastward. On the 20th, the storm-centre was in Tennessee, the barometer at Memphis reading 29.75 (755.6), wind nw., light rain. During the 20th, the movement appears to have been more rapid than on the preceding days, and on the 21st, the storm-centre was in Pennsylvania. The barometric gradient had rapidly increased in the northeastern quadrants of the storm, and violent northeasterly and east-southeasterly gales prevailed in the districts lying north and east of the centre. On the 22d, the disturbance passed off the New England coast into the Atlantic, causing snow in the Canadian Maritime Provinces. On the 23d, the storm-centre was to the eastward of Newfoundland, the s. s. "Vaderland," in N. 49°, W. 46°, reporting strong sse. to wnw. gale, with snow squalls. During the 23d, the disturbance moved by a northeasterly course to about N. 50°, W. 40°, where it was central on the morning of the 24th; the s. s. "Ohio," in N. 48° 07′, W. 40° 38′, reported barometer 28.93 (734.8), wind w., force 4, cloudy, and the s. s. "Donau," in N. 50°, W. 35°, encountered a heavy sse. gale. The storm-centre then moved slowly eastward, or slightly to the south of east, and, on the 25th, it was near N. 47°, W. 33°; on that date, the s. s. "Rhynland," in N. 48° 10′, W. 31° 45′, reported barometer 28.54 (724.9), wind e., force 8, weather threatening; in N. 50° 38′, W. 38° 55′, the s. s. "Ethiopia" reported barometer 28.97 (735.8), wind w., force 3, raining, and the s. s. "Celtic," in N. 46° 06′, W. 39° 15′, barometer 29.01 (736.8), wind nne., force 5, weather fair. On the 26th, the path of the storm-centre again changed to the northeastward, but the centre of disturbance apparently moved very slowly, and was then near N. 49°, W. 29°; the s. s. "Celtic," in N. 48° 12′, W. 32° 00′, reported barometer 28.37 (720.6), wind n., force 5, cloudy, heavy easterly sea; the s. s. "Hermann," in N. 47° 51′, W. 29° 43′, barometer 28.52 (724.4), wind sw., force 6, clearing weather; the s. s. "Rhynland," in N. 48° 57′, W. 27° 07′, barometer 28.43 (722.1), wind w., force 5, cloudy. On the 26th, the low-area became elongated, the region of barometric minima occupying nearly the same position as on the 26th; during the 27th, the centre began to move eastward, and by the morning of the 28th, it was off the southwest coast of Ireland. The subsequent course of this disturbance is hereafter described under low-area xxvi.

X.—This disturbance first appeared in the Pacific, on the 25th, and was then apparently central off the coast of Washington Territory. During the 26th and 27th, the depression moved slowly southward along the coast, and entered Oregon on the 28th, causing heavy rains in California and Washington Territory; much damage resulted from floods in the sections above-mentioned. During the 28th the disturbance moved rapidly eastward, crossed the Rocky mountains, and, on the 29th, appeared in Nebraska. It continued its easterly movement with gradually increasing pressure at the centre, and finally disappeared in the lake region.

X*a*.—This depression probably developed over the ocean between the coast of the United States and the Bermudas. On the 26th, the bark "St. Anna," in N. 35° 35′, W. 68° 53′, encountered a hurricane from sw. to se., which lasted until the 27th; on the 28th, the brig "Margrethe," in N. 37°, W. 68°, had a heavy gale from w. and nw., with high sea and heavy

rain; the gale continued, with more or less violence, until February 1st. On the 29th, the centre of disturbance was apparently near N. 40°, W. 55°; on that day, the s. s. "Nova Scotian," in N. 40° 41′, W. 55° 09′, reported barometer 29.36 (745.7), wind variable, force 1, sleeting, while strong nw. gales, with snow, prevailed in the western quadrants of the depression. On the 30th, the storm-centre was between 40° and 50° north latitude, and probably near the forty-fifth meridian; the s. s. "Nova Scotian," in N. 42° 02′, W. 51° 32′, reported barometer 29.28 (743.7), wind nnw., force 3. On the 31st, this disturbance probably merged in a large depression which occupied the ocean, the region of lowest pressure then lying off the British Isles.

XI.—This depression appeared in Texas on the 30th; it moved northeastward and, at the close of the month, was central in eastern Missouri. During its passage, rain fell at stations north and east of the centre.

XII.—This depression appeared on the 1st, west of Upernavik, Greenland; it moved in a southeasterly direction and, on the 2d, was central in southern Greenland. During the 3d and 4th, the centre apparently remained near the southern extremity of Greenland, and, on the 5th, the disturbance probably united with low-area i.

The following descriptions relate to the storms that occurred in Europe during the month:

XIII.—This disturbance was central off northern Norway on the 2d. It moved by a southeasterly course over Finland, and on the 4th was central over the White sea. The depression continued its eastward movement during the 5th, and on the 6th, it entered western Siberia, accompanied by a slight rise in temperature. On the 7th, the disturbance had passed beyond the stations of observation.

XIV.—This storm first developed near the coast of Algeria on the 3d. It moved northeastward over the Mediterranean, and, on the 4th, was central near Majorca, Balearic Isles, attended by cloudy weather and rain in the northern quadrants. On the 5th, the disturbance was central, with slightly decreased pressure, between Italy and the island of Corsica; on that day, the area of disturbance increased and the barometric fall extended over central Europe, accompanied by a rise in temperature and general rains in that region. On the 6th, the path of the centre of disturbance changed slightly and the lowest barometric readings were shown over central Italy. On the 7th, the pressure decreased in southern Italy, and the circulation of the winds indicated the presence of the centre near the entrance to the Adriatic sea. On the morning of the 8th, the area of lowest readings was inclosed by the isobars of 29.80 (756.9) and on the 9th, the disturbance, moving over Greece, disappeared near the Black sea.

XV.—This depression, enclosed by the isobar of 29.00 (736.6), appeared off the northwestern coast of Norway on the 6th. It moved southeastward during the 7th and 8th, causing stormy westerly and northwesterly winds in the Scandinavian peninsula and in northwestern Russia. During the 8th, the disturbance moved eastward and disappeared near the Ural mountains.

XVI.—This depression appeared in Scandinavia on the 9th, and caused a slight decrease of pressure over Scotland. Owing to the presence of an area of high-pressure which occupied the North sea and the British Isles, very steep gradients were formed, and strong westerly and northwesterly winds occurred at stations in Sweden and Norway. On the 10th, the centre of disturbance was in the Baltic provinces of Russia, the pressure having decreased as the disturbance moved southeastward; Dorpat, barometer 29.03 (737.3), wind nnw., force 7, snowing. During the 10th and 11th, the course changed to northeasterly, and on the 12th, the disturbance appeared near Archangel, Russia. The pressure increased as the centre moved northeastward, and the temperature fell more than ten degrees in northern Russia. On the 13th, the area of least pressure was over northern Scandinavia and northern Finland, whence it moved southward, and on the 14th, was near the northern part of the Gulf of Bothnia. The remains of this depression probably united, on the 15th, with low-area xx.

XVII.—This disturbance appeared on the 11th in the Mediterranean. It caused a slight but general decrease of pressure over central and western Europe, and rain fell at stations in southern France. The depression moved eastward, and on the 12th, was in northern Italy. On the 13th, the centre was near the southwestern coast of Austro-Hungary, where it was probably re-inforced by low-area xviii., which had advanced southeastward through central Europe. On the 14th, the region of low-pressure was transferred to the Black sea, and was accompanied by strong southwesterly breezes and snow, with slightly higher temperature. During the 14th, the disturbance moved in a north-northeasterly direction, and, on the 15th, was central, with decreased pressure, near Moscow, Russia. Strong westerly winds occurred at stations south of the centre, and strong northeasterly winds prevailed in the northern quadrants. On the morning of the 16th, the depression was central near Archangel, barometer 28.93 (734.8), wind nne., snowing; during the day, the disturbance disappeared in the Arctic ocean.

XVIII.—This depression developed over the North sea on the 11th, and on the 12th, it appeared as a well-defined low-area, with its centre near the eastern coast of England. It moved southeastward and entered the continent during the 12th; snow fell generally at stations in central Europe, and a slight rise in temperature occurred. On the 13th, the storm-centre was in southern Germany, and during the day, the disturbance probably united with low-area xvii.

XIX.—This is a continuation of the storm traced as low-area i. of the present chart. On the 14th, the depression presented the form of an elongated ellipse, with its eastern limit in the Iberian peninsula. Rain and snow occurred at stations along the southern shores of the Bay of Biscay, and cloudy weather, or rain, was general at stations east of the centre. On the 15th, the area of low barometer, 29.60 (751.8), extended from Spain to the western shores of the Black sea, the lowest readings being over Italy. On that day, the pressure remained relatively low over central Europe, and a remarkable fall of temperature occurred in Germany. At Munster, province of Westphalia, and at Leipsic, Saxony, the temperature fell to —13° Fahr. (—25° Cent.), and in all parts of Germany and Austria, the fall was more or less marked. On the 16th, the depression moved to the Adriatic sea, and a general increase of pressure set in over central Europe and over Spain. On the 17th, the lowest pressure was transferred to the Crimea; during the passage of the centre, rain or snow fell at stations near its path, and strong northerly winds prevailed over the Black sea. During the 17th, the storm-centre moved northeastward, causing strong westerly gales at stations on the western shores of the Caspian sea, and on the 18th, the disturbance disappeared in western Siberia.

XX.—This depression appeared in southern Sweden on the 15th, and was attended by a rise in temperature over the Scandinavian peninsula, Scotland, and at stations on the shores of the Baltic. The disturbance moved into Russia on the 16th, and probably united, during the day, with low-area xvii. then central near Moscow.

XXI.—In western Europe, this was the most noteworthy storm of the month, on account of the violent and prolonged snow-storm that occurred during its passage. After the passage of low-area i., the barometer remained low over the Azores, but, on the 16th, a further decrease of pressure occurred, and an independent area of low barometer was formed over these islands. The disturbance moved northeastward and, on the 17th, was central near the southern part of the Bay of Biscay. Rain and snow fell at stations in Spain and Portugal, and in western France, and a decided rise in temperature occurred in those districts, and included also the southern part of England. On the 18th, the storm-centre was in the English Channel; violent easterly gales prevailed over the North sea, and at nearly all stations in the British Isles, while strong

westerly gales occurred in the Bay of Biscay and in western France. On the 18th, an unusually heavy fall of snow occurred in England and in the northern half of France. In the southern counties of England, the snowfall ranged from ten to eighteen inches, and, in some instances, the latter amount may have been exceeded. Snow-drifts of four to twelve feet were general over southern England, and, in some cases, they attained a depth of twenty feet. Mr. H. Sowerby Wallis, F. M. S., writing to Symons' Monthly Meteorological Magazine "On the Snow Storm of January, 1881," states:

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"The gale was particularly severe on the east coast, but the number of wrecks and casualties on all the coasts was very great; reports from many seaports stating that it was the most severe gale that had been experienced for more than thirty years. Much damage was done to roofs, &c., and a large number of trees were blown down in the eastern counties. * * * In London, an extremely high tide, increased by the gale, overflowed the low-lying districts on the south of the Thames, and caused much distress. * * * The gale was accompanied by a heavy and steady fall of snow over all but the north of England, which lasted through the 18th, and continued, though rather lighter, till about noon of the 19th. The amount of snow deposited over the whole of the southern portion of the country was very great, and was so drifted by the fierce wind that communication both by road and rail was entirely disorganized, and it was more than a week before the railway and postal arrangements throughout the country recovered their usual regularity and punctuality; the interruption to business was further increased by the large number of telegraph-wires which were broken by the gale or by contraction caused by the extreme cold. * * * Among careful observers in all parts of the country where the snow fell with its full intensity, it appears to be the general opinion that, to find anything like a parallel case, we must go back to 1836 or to 1814; and it would appear that in most parts of the country the depth in those years was greater, but that the drifts were not so great. As regards the fall in the Isle of Wight and in south Hampshire, it is believed to be altogether unprecedented in recent times. * * * The loss of life in England and Wales entirely due to the snow, was very great, and probably an estimate of one hundred persons would be very near the truth, and the amount of distress occasioned simply by the stoppage of the supplies of food and fuel to country districts from towns is almost incalculable."

In Paris, the snow-storm was also very severe and caused serious delays in the transmission of telegrams, mails, and in other business. Hundreds of market-wagons were abandoned near the suburbs of Paris, in the heavy drifts which had formed, and many of the streets of Paris were completely blocked. At Lille, in northern France, many houses were damaged and large numbers of trees were blown down, and railroad travel was completely suspended. By the 19th, the storm-centre had moved over Belgium and Holland into Germany; during that day snow fell at most stations in Germany, and strong easterly and northeasterly gales prevailed at stations in the northern sections. Snow continued to fall in France and England, and southwesterly to northwesterly winds prevailed in the former country, while in the latter, they shifted to northerly. On the morning of the 20th, the centre of disturbance was in eastern Prussia, whence it moved rapidly eastward, and on the 21st, it was in central Russia; and strong westerly and northwesterly winds prevailed at stations in European Russia. On the 22d, the storm-centre, having moved northeastward, was in the vicinity of the Ural mountains, and to the northeast of Ekaterinburg. On the 23d, the disturbance was in western Siberia, accompanied by rain, snow, and higher temperature; during the day the disturbance disappeared beyond the stations of observation. After the passage of this disturbance, the temperature fell generally throughout central Europe and Russia, and at no time during the prevalence of this storm did it rise above freezing.

XXII.—This disturbance appeared as a slight depression 29.80 (756.9), off the coast of Portugal on the 21st. It moved over the Iberian peninsula, with decreasing pressure at the centre, and on the 22d, was central over the Mediterranean. On the 23d, the region of least pressure was over the Adriatic; during those days, cloudy weather prevailed over Italy, and rain and snow fell at Constantinople, Turkey. By the 24th, the disturbance had moved over the Black sea, and was central near the Caucasus mountains; it then moved eastward over the Caspian sea, and disappeared in western Asia on the 25th.

XXIII.—This depression developed near the Azores on the 23d; it moved eastward, and was central off the coast of Portugal on the 24th, causing cloudy weather and rain over the peninsula. The course then changed to northeasterly, and, on the 25th, the disturbance was central in the Bay of Biscay. Strong easterly gales occurred in the Bay of Biscay, and generally cloudy weather with rain or snow prevailed at the adjacent land stations. On the 26th, the storm-centre was in northern France, where it probably combined with the low-pressure which was spreading over Europe in advance of a deep depression, number ix, then moving toward the British Isles.

XXIV.—This disturbance appeared in northern Scandinavia on the 23d; during the day, it moved in a southeasterly direction towards the White sea, causing rain or snow and rising temperature over northern Europe. On the 24th, the centre of disturbance was near the White sea; on the 25th, it moved to the westward, and strong westerly and southwesterly winds occurred over Scandinavia. The depression remained in northern Scandinavia on the 26th, and disappeared in the Arctic ocean on the following day.

XXV.—This was a secondary depression which developed near the Hebrides on the morning of the 28th, while low-area xxvi, was off the southwest coast of Ireland. It probably united with the central area on the 29th.

XXVI.—This is a continuation of the storm before described as low-area ix. On the 28th, the disturbance was central as a large and deep depression off the coast of Ireland; it moved northward along the Irish coast, and, on the morning of the 29th, was central in the north of Ireland. A decided rise in temperature occurred over the British Isles, and generally heavy rains prevailed over those islands, and over western Europe. During the 30th and 31st, the depression moved slowly northward along the western coast, the pressure slowly increasing at the centre, but at the close of the month, the barometric pressure remained low over the British Isles.

A special feature in the weather of the month was the prevalence of remarkable low temperatures and severe frost in Europe. The subject will be fully noted in the description of chart iv. for January, 1881.

The following descriptions are given of the storms that appeared in eastern Asia:

XXVII.—This was a slight depression which probably developed in northeastern Asia; it moved eastward but did not develope any special energy until after crossing the peninsula of Corea and entering the Japan sea on the 6th. The s. s. "Appin," north of the Oki islands, encountered fresh southerly to south-southeasterly winds on the night of the 5th. On the morning of the 6th, the wind shifted to southwesterly and increased in force. At noon of the same day, the barometer reached its lowest reading, 29.64 (752.8), wind wsw., afterward varying between w. and wnw., and increasing to force 9. The disturbance finally disappeared in the Pacific on the 7th.

XXVIII.—A decrease of pressure occurred over Japan on the 7th and 8th, and on the latter date, the disturbance appeared central in the island of Niphon. On the 9th, it passed off to the Pacific ocean and was immediately followed by violent northwesterly gales over Niphon.

XXIX.—On the 10th, a decided barometric fall occurred over the eastern part of Niphon, the centre of disturbance being probably at some distance from the coast-line. On the following day, the barometer began to rise and the depression passed eastward over the ocean. On the 10th, the s. s. "Belgic," in N. 35° 59′, E. 162° 02′, reported barometer 30.08 (764.0), wind ssw., force 5, high sw. sea and cloudy weather; on the 11th, the same vessel, in N. 35° 45′, E. 158° 29′, reported barometer 29.76 (755.9), wind sw., high w. swell and clear weather.

XXX.—On the 17th, the pressure decreased in northern China, the U. S. S. "Ashuelot," at Tientsin, reporting barometer 29.95 (760.7), a fall of .38 inch, weather cloudy. The barometric fall extended southward along the coast of China, and on the 18th, the region of least pressure was over the Japan sea, and cloudy and rainy weather prevailed in Japan. The depression

passed in a northeasterly direction over Niphon, and disappeared in the ocean on the 19th, followed by strong northwesterly gales in the sw. quadrant.

XXXI.—On the 24th, the s. s. "City of Tokio," in N. 35° 33′, E. 146° 45′, reported barometer 29.46 (748.3), wind wsw., force 8, weather cloudy. The reports of the 25th, 26th, and 27th, from the above-named vessel indicate that the depression passed northeastward over the Pacific as a somewhat severe storm, being accompanied by strong wind of force 6–8.

XXXII.—This disturbance appeared in Niphon on the 28th, attended by cloudy weather and rain. During the 29th and 30th, the pressure remained low over Japan, but on the last day of the month, it began to increase, and the weather cleared.

This month, like the preceding, was marked by the continued presence of barometric minima over Japan, while high-pressures prevailed almost without interruption throughout the month, in China.

TEMPERATURE OF THE AIR.

The distribution of mean temperature, over the United States and Canada, for the month of December, 1882, is exhibited on chart ii., by the dotted isothermal lines. The table of comparative mean temperatures in the lower left-hand corner of the chart, shows the average temperature for the month in the several districts, as determined from observations taken at the Signal Service stations during the month of December in previous years.

The month of December, 1882, has been colder than the average for December in the Southern, middle, and New England states, and in the regions east of the Missouri valley. It has averaged about 3° below the mean in the Southern states east of the Mississippi river, and over 1° below the average in New England, the middle states, the lower lake region, the Ohio and upper Mississippi valleys. At the Rocky mountain stations and thence westward to the Pacific coast the temperature has been above the mean for the month, the warmest weather being reported from Colorado, Nevada, Wyoming, and on the north Pacific coast, where it averaged from 3° to 5° above the mean for the month. In California and Arizona, the temperature averaged about 1° above the mean. The average temperature on the summits of Mount Washington and Pike's Peak was slightly above the mean for the month.

DEVIATIONS FROM MEAN TEMPERATURE.

The departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperature on the left-hand of chart ii.

The Chief Signal Officer is indebted to voluntary observers

Table of Comparative Minimum Temperatures for the Month of December.

State or Territory.	Minimum for December, 1882, Signal Service.		Lowest since Signal Service stations were opened—3 to 11 years.			Lowest from any other source.			
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Year.	Length of Record.
		°		°			°		*
Alabama	Montgomery	19	Montgomery	8	1880	Huntsville	— 7		9 years.
Do						Thomas Barracks	10	1875	2 "
Arizona	Prescott	10	Prescott	—18	1879	Fort Canby	—25		12 "
Arkansas	Fort Smith	10	Little Rock	6	1880	Washington, near	— 6	1845	27 "
Do						Fort Smith	0		21 "
California	Red Bluff	25	Campo	7	1878	Fort Jones	—17	'55, '57	5 "
Do						Camp Bidwell	—10		18 "
Colorado	Pike's Peak	—15	Pike's Peak	—37	1878	Fort Garland	—30		39 "
Do						Fort Lyon	—30	1876	20 "
Connecticut	New Haven	4	New Haven	— 4	1880	Middletown	—18	1860	11 "
Dakota	Tobacco Garden	—35	Pembina	—49	1876	Fort Stevenson	—34	1879	7 "
Do			Forts Buford and Stevenson	—46	1879	Fort Totten	—51	1879	7 "
Delaware	Delaware Breakwater	14	Delaware Breakwater	1	1880	Fort Delaware	9		44 "
Do						Dover	6	1876	6 "
Dist. of Columbia	Washington	8	Washington	—13	1880	Washington	—10		48 "
Florida	Pensacola	25	Pensacola	17	1880	Fort Barrancas	15		52 "
Georgia	Atlanta	12	Atlanta	1	1880	McPherson Barracks	— 1	1880	7 "
Idaho	Eagle Rock	—25	Lewiston	—16	1879	Fort Hall	—30	1879	10 "
Illinois	Champaign	—14	Chicago	—15	1880	Rock Island Arsenal	—26	1872?	14 "
Indiana	Indianapolis	—10	Indianapolis	—15	1876	Wabash	—19	1880	6 "
Indian Territory	Fort Supply	5	Fort Gibson	— 9	1876	Fort Sill	—11	1872?	10 "
Iowa	Des Moines	—17	Dubuque	—19	76,79,80	Cresco	—35	1879	8 "
Kansas	Leavenworth	— 5	Dodge City	—15	1876	Fort Wallace	—24	1876	8 "
Kentucky	Louisville	4	Louisville	— 7	1880	Newport Barracks	— 8		28 "
Louisiana	Shreveport	22	Shreveport	—10	1880	Okalooska	10	1880	3 "
Do						Fort Jessup	14		22 "
Maine	Eastport	5	Eastport	—20	1875	Gardiner	—24		45 "
Maryland	Baltimore	10	Baltimore	— 3	1880	Emmittsburg	—19	1880	7 "
Massachusetts	Boston	6	Boston	—11	1875	Bill rica	—20	1876	8 "
Do						New Bedford	—10	1860?	60 "
Michigan	Escanaba	—12	Escanaba	—23	1880	Fort Brady	—41	1872?	58 "
Minnesota	Saint Vincent	—30	Saint Vincent	—42	1880	Fort Ripley	—40		14 "
Mississippi	Starkville	13	Vicksburg	12	1880	Fayette	11	1880	8 "
Missouri	Saint Louis	— 6	Saint Louis	—15	1880	Rolla, near	—23	1870	7 "
Montana	New Chicago	—34	Fort Benton	—39	1880	Camp Baker	—33	1871	9 "
Do						Fort Benton	—54	1880	14 "
Nebraska	Omaha	—15	North Platte	—27	1879	Sydney Barracks	—37	1879	5 "
Do						Glendale	—30	1868	2 "
Nevada	Winnemucca	— 4	Winnemucca	—20	1879	Fort Halleck	—22	1879	12 "
New Hampshire	Mount Washington	—25	Mount Washington	—47	1876	Dartmouth College	—29		18 "
Do						Stratford	—24		11 "
New Jersey	Sandy Hook	3	Atlantic City	— 7	1880	Linden	—18	1880	6 "
Do			Barnegat	— 7	1880				
New Mexico	Santa Fé	— 1	Santa Fé	—13	1879	Fort Union	—28	1855	30 "
New York	Oswego	3	Albany	—17	1875	Madison Barracks	—44	1871	54 "
North Carolina	Charlotte	10	Charlotte	— 5	1880	Lenoir	—16	1880	5 "
Do						Fort Johnson	9		54 "
Ohio	Cleveland	— 9	Sandusky	—13	1880	Kenton	—20	1876	3 "
Do						College Hill	—12	1880	65 "
Oregon	Umatilla	6	Portland	3	1879	Eola	— 8	1879	7 "
Pennsylvania	Pittsburg	— 1.5	Erie	—11	1880	Lewisburg	—23	'65?, '67?	6 "
Rhode Island	Narragansett Pier	5	Newport	— 3	1875	Providence	—12		36 "
South Carolina	Charleston	24	Charleston	13	1880	Aiken	3	1880	7 "
Do						Charleston	20	1851?	104 "
Tennessee	Knoxville	5	Knoxville	— 5	1880	Clarksville	— 4	1880	8 "
Texas	Fort Elliott	1	Fort Elliott	—10	1879	Camp Stockton	— 9	1859	15 "
Utah	Salt Lake City	12	Salt Lake City	—10	1879	Fort Crittenden	—22	1859	3 "
Vermont			Burlington	—19	1879	Lunenburg	—30	1868	20 "
Virginia	Lynchburg	8	Fort Whipple	—11	1880	Dover	—34	1880	2 "
Do						Fort Monroe	17		56 "
Washington	Colfax	— 5	Olympia	—17	1879	Fort Colville	—22	1861?	21 "
Do						Fort Townshend	—22	1872	23 "
West Virginia	Morgantown	3	Morgantown	— 9	1880	Flemington	—21	1880	2 "
Wisconsin	La Crosse	—20	La Crosse	—26	1879	Fort Howard	—38		31 "
Wyoming	Fort Washakie	—27	Cheyenne	—24	'79-'80	Fort Fetterman	—36	1872?	14 "

for the following interesting items bearing upon this subject. These comparisons are of special importance, as many of the records from which they are made cover long periods of time, some extending back many years before the establishment of the Signal Service:

Illinois.—Riley, mean temperature, 19°.4, or 1°.4 below the December average of the last twenty-one years. The mean temperature of the year 1882 is 45°.7, or 0°.8 above the annual mean of nineteen years. The maximum temperature of the year, 89°, occurred June 22d; minimum, —14°, occurred December 7th.

Anna, mean temperature, 35°.16, is 1°.59 below the average of a period of seven years.

Indiana.—Logansport, mean temperature, 28°.8, is 1°.5 above the December average since 1860. During that period the highest December mean, 45°, occurred in 1877; the lowest, 14°, occurred in 1872.

Vevay, mean temperature, 33°.9, corresponds with the December normal.

The following table, furnished by Dr. T. C. Hunter, of Wabash, Indiana, shows the monthly and annual mean temperatures at that place for the six years, ending December 31, 1882:

Month.	1877.	1878.	1879.	1880.	1881.	1882.	Monthly means.
	°	°	°	°	°	°	°
January	21.00	30.33	23.25	40.00	20.00	29.62	27.37
February	37.00	33.33	25.67	35.40	27.18	38.47	35.68
March	30.00	45.67	37.50	38.19	34.98	43.05	38.20
April	50.00	55.50	48.25	53.67	45.62	51.64	50.78
May	59.40	57.67	61.00	66.46	69.83	58.74	62.12
June	67.75	65.00	67.00	74.40	73.13	70.58	69.64
July	71.50	70.00	72.33	76.32	78.12	70.94	74.68
August	70.50	71.00	71.60	72.89	78.86	72.36	72.77
September	60.33	65.00	59.25	63.60	73.64	60.87	63.78
October	55.33	51.67	60.00	49.15	58.57	56.63	55.22
November	39.00	41.50	41.50	28.19	46.10	40.23	39.52
December	42.00	22.50	30.67	21.61	37.78	27.79	30.49
Annual means	50.28	51.51	49.83	51.67	53.69	51.74	51.85

It will be seen from the above table that the mean temperature of December, 1882, is 2°.7 below the average of December during the period covered by the record.

Iowa.—Iowa City, the following extract is taken from "Press Bulletin," number 116, for December, 1882, published by Dr. Gustavus Hinrichs, director of the Iowa Weather Service:

* * * * "The mean temperature of the air was nearly three degrees below the normal. The first half of the month was very cold and fair; the last half was nearly normal but very cloudy. The coldest days were the 6th, 7th, and 8th, averaging thirty degrees below the normal; the 20th and 21st were the warmest, the mean temperature being fourteen degrees above the normal, causing a general thaw and break up in rivers."

Clinton, mean temperature, 21°.3, is 7° below the December normal.

Kansas.—Wellington, mean temperature, 30°.02, is 0°.7 below the December average of the last three years. The mean temperature of the year of 1882 is 53°.8 or 1°.2 below the annual average of the last four years.

Yates Centre, mean temperature, 29°.65, is 0°.71 above the December average of the last three years.

Lawrence, mean temperature, 31°.25, is 1°.76 above the December average of the last fifteen years. The highest December mean temperature of that period, 44°.43, occurred in 1867; the lowest, 19°.93, occurred in 1872; the highest maximum temperature, 73° occurred in 1875; lowest minimum temperature, —18°, occurred in 1872. The following interesting table, taken from the annual summary prepared by Professor F. H. Snow, of the State University at Lawrence, shows the mean temperatures and annual extremes at that place since 1868:

Year.	Max.	Min.	Mean.	Year.	Max.	Min.	Mean.
	°	°	°		°	°	°
1868	101	—16.5	53.36	1876	98	— 5	52.76
1869	96	— 5	50.99	1877	99	— 9	54.16
1870	102	—10	54.50	1878	98	— 6	55.33
1871	103	— 6	54.30	1879	99.5	—16	54.67
1872	97	—18	51.90	1880	101	—12	54.01
1873	104	—26	52.71	1881	104	— 8	54.65
1874	108	— 3	54.20	1882	105	— 6.5	54.94
1875	90	—16.5	50.60	Means	101	—12.2	53.53

Maine.—Gardiner, mean temperature is 20°.31, or 1°.95 below the December average of a period of forty-seven years.

Maryland.—Fallston, mean temperature, 31°.03, is 2°.03 below the December average of the last thirteen years. The highest December mean of that period, 40°.25, occurred in 1877; the lowest, 23°.63, occurred in 1876.

Missouri.—Saint Louis, the Missouri Weather Service reports the mean temperature to be 32°.5, or 0°.7 below the December normal. The first decade was about 4° colder, and the last decade about 4° warmer than the normal.

New Hampshire.—Grafton, mean temperature, 20°.3, is 3°.6 below the December average of the four years from 1877 to 1880, inclusive.

New York.—Palermo, mean temperature, 23°.7, is 0°.7 below the December average of the last twenty-nine years. The highest December mean temperature of that period, 32°.1, occurred in 1881; the lowest, 16°.8, occurred in 1880. The mean temperature of the year of 1882, 43°.3, is 1° below the annual average of twenty-nine years. During that period the highest annual mean, 51°.8, occurred in 1878; the lowest, 43°.2, occurred in 1882. The mean temperatures of the seasons of 1882 are: spring, 40°.7; summer, 65°.7; autumn, 43°.5; winter, 23°.5. North Volney, mean temperature is 45°.46, which is the December normal of the last fifteen years. The highest December mean temperature, 33°.73, occurred in 1881; the lowest, 18°.02, occurred in 1876. The mean temperature of the year of 1882 is 45°.49, or 0°.09 above the annual average of fourteen years. The highest annual mean of that period is 47°.74 for 1878; the lowest, 41°.61, for 1875. The mean temperature of the year at 7.00 a. m. is 42°.15; at 2.00 p. m., 52.°68; at 9.00 p. m., 43°.57; and the annual range 112°.

Vermont.—Woodstock, mean temperature, 17°.91, is 1°.59 below the December average of a period of fifteen years. The highest December mean of that period is 30°.14, which occurred in 1881; and the lowest, 8°.62, occurred in 1872; the highest maximum temperature, 62°, occurred December 14, 1881; lowest minimum, —41°.5, occurred December 25, 1872.

Virginia.—Variety Mills, mean temperature, 52°.3, is 4°.9 below the December average of the last six years. The highest December mean of that period, 43°.3, occurred in 1879; the lowest, 30°.6, occurred in 1876.

The following table, furnished by Mr. C. R. Moore, of Snowville, shows the monthly and annual mean temperatures at that place since 1869:

Month.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	Monthly means.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	42.13	45.72	38.17	35.39	38.29	43.04	34.02	46.37	37.53	41.11	36.94	49.44	33.67	40.24	40.16
February	42.33	39.72	41.84	39.66	38.23	41.28	34.78	42.77	43.04	44.17	37.44	47.77	38.36	46.72	41.29
March	43.19	43.52	32.39	37.64	43.10	46.78	44.10	43.37	45.87	54.07	48.74	48.96	45.96	49.58	46.23
April	54.14	52.90	50.34	54.85	53.72	49.87	49.38	53.09	55.37	60.95	55.56	61.59	53.42	55.00	54.94
May	56.50	63.65	65.02	66.27	61.64	61.66	63.10	63.24	63.78	66.81	67.57	73.70	67.96	62.92	64.56
June	73.77	74.28	73.09	72.96	72.75	74.88	70.16	74.27	76.45	72.78	74.49	77.73	74.73	76.42	74.19
July	76.98	79.49	77.53	79.71	76.15	75.31	77.91	79.17	81.05	83.25	80.01	81.42	80.33	79.88	79.16
August	74.87	77.65	74.91	78.35	76.07	72.05	74.19	76.50	80.10	80.13	77.77	77.83	77.91	78.75	76.93
September	69.65	71.00	65.97	64.57	68.68	57.10	66.67	69.13	61.22	74.62	71.07	73.49	79.75	74.49	70.03
October	54.81	61.90	63.82	58.53	56.92	59.34	57.42	55.24	64.54	62.64	67.78	62.21	69.24	66.21	61.47
November	43.43	50.00	47.07	45.30	45.73	49.35	46.16	49.02	53.90	51.92	52.30	46.55	55.55	48.72	48.93
December	42.07	38.73	38.66	33.93	43.69	42.60	43.43	32.72	47.80	39.58	51.06	35.32	47.67	39.32	41.18
Sums	673.87	698.56	697.72	667.16	674.97	686.26	661.32	684.89	710.63	732.03	729.73	736.01	724.55	718.85	699.07
Means	56.16	58.21	58.14	55.59	56.25	57.19	55.11	57.07	59.22	61.00	60.06	61.33	60.38	59.85	58.26

West Virginia.—Helvetia, mean temperature, 31°.56, is 1°.35 below the December average of six years. The mean temperature of the year 1882 is 51°.40, or 0°.90 above the annual average of six years.

RANGES OF TEMPERATURE AT SIGNAL SERVICE STATIONS.

Monthly ranges of temperature during December, 1882, have varied from 29° at Portland, Oregon, and Key West, Florida, to 82° at Rapid City, Dakota; 83° at Fort Benton, Montana, and 89° at New Chicago, Montana. The smallest monthly ranges are: Portland, Oregon, and Key West, Florida, 29°; San Francisco, California, 30°; Mackinac City, Michigan, and Williamsport, Pennsylvania, 31°; Oswego, New York, 35°. The largest are: New Chicago, Montana, 89°; Fort Benton, Montana, 83°; Rapid City, Dakota, 82°; Fort Washakie, Wyoming, 79°; Eagle Rock, Idaho, 76°; Fort Bennett, Dakota, 76°; West Las Animas, Colorado, 76°; Fort Assinniboine, Montana, 75°; Cheyenne, Wyoming, 74°; Fort Elliott, Texas, 74°; Glendive, Montana, 72°; Omaha, Nebraska, 72°; Yankton, Dakota, 72°; Phœnix, Arizona, 71°; Cartersville, Montana, 70°; Huron, Dakota, 70°; North Platte, Nebraska, 69°; Fort Stevenson, Dakota, 69°; Helena and Terry's Landing, Montana, 69°; Des Moines, Iowa, 67°; Indianapolis, Indiana, 67°; Saint Louis and Springfield, Missouri, 66°; Denver, Colorado, 66°; Fort Stockton, Texas, 65°; Moorhead, Minnesota, 55°; Davenport, Iowa, 65°. The greatest daily ranges have varied in the different districts as follows:

New England.—From 25°, at Springfield, Massachusetts, on the 3d, to 42° on the summit of Mount Washington on the 3d.

Middle Atlantic states.—From 22° at Williamsport, Pennsylvania, on the 7th, to 37° at Cape May, New Jersey, on the 6th, and at Norfolk, Virginia, on the 7th.

South Atlantic states.—From 25° at Fort Macon, North Carolina, on the 7th and 9th, and at Jacksonville, Florida, on the 4th, to 39° at Atlanta, Georgia, on the 7th.

Florida Peninsula.—From 14° at Key West, on the 16th, to 24° at Punta Rassa, on the 1st and 16th.

East Gulf states.—From 26° at New Orleans, Louisiana, to 39° at Starkville, Mississippi, on the 7th.

West Gulf states.—From 21° at Port Eads, Louisiana, on the 7th, and 25° at Little Rock, Arkansas, on the 7th and 17th, to 39° at Fort Smith, Arkansas, and San Antonio, Texas, on the 17th.

Ohio valley and Tennessee.—From 24° at Indianapolis, Indiana, on the 8th, and 25° at Louisville, Kentucky, on the 7th, to 38° at Columbus, Ohio, on the 7th.

Lower lake region.—From 22° at Sandusky, Ohio, on the 7th, to 33° at Cleveland, Ohio, on the 7th.

Upper lake region.—From 19° at Port Huron, Michigan, on the 9th, to 34° at Duluth, Minnesota, on the 17th.

Extreme northwest.—From 32° at Bismark, Dakota, on the 23d, and at Saint Vincent, Minnesota, on the 11th, to 35° at Moorhead, Minnesota, on the 8th.

Upper Mississippi valley.—From 22° at Cairo, Illinois, on the 6th and 11th, and 23° at La Crosse, Wisconsin, on the 6th, 8th, 11th and 16th, to 32° at Saint Paul, Minnesota, on the 8th, and at Des Moines, Iowa, on the 11th.

Missouri valley.—From 34° at Huron, Dakota, on the 26th, to 42° at Fort Bennett, Dakota, on the 1st.

Northern slope.—From 32° at Helena, Montana, on the 14th, and 33° at Fort Custer, Montana, on the 15th, to 47° at Fort Benton, Montana, on the 15th, and 48° at Cheyenne, Wyoming, on the 7th.

Middle slope.—From 28° at Pike's Peak, Colorado, on the 9th, to 48° at Fort Elliott, Texas, on the 17th, and 58° at West Las Animas, Colorado, on the 8th.

Southern slope.—From 33° at Jacksborough, Texas, on the 6th, to 44° at Coleman City, Texas, on the 18th.

Southern plateau.—From 28° at Fort Grant, Arizona, on the 29th, and 29° at Santa Fé, New Mexico, on the 7th, to 50° at Fort Apache, Arizona, on the 14th.

Middle plateau.—From 20° at Salt Lake City, Utah, on the 4th, to 40° at Fort Washakie, Wyoming, on the 8th.

Table of Maximum and Minimum Temperatures for December, 1882.

State or Territory.	Signal Service. Station.	Max.	Min.	U. S. Army Post Surgeons, or Voluntary Observers. Station.	Max.	Min.
		°	°		°	°
Alabama	Mobile	74	24	Mount Vernon Barracks	78	20
Do	Montgomery	70	19	Auburn	67	14
Arizona	Phœnix	95	24	Fort Lowell	82	9
Do	Prescott	68	10			
Arkansas	Little Rock	67	17	Mount Ida	66	14
Do	Fort Smith	66	10			
California	Los Angeles	82	35	Anaheim	92	40
Do	Red Bluff	74	25	Fort Bidwell	70	−1
Colorado	West Las Animas	69	−6	Fort Lyon	69	−7
Do	Pike's Peak	27	−15	Pagosa Springs	54	−21
Connecticut	New London	53	7			
Do	New Haven	52	4			
Dakota	Fort Bennett	57	−19	Fort Randall	59	−20
Do	Rapid City	57	−25	Fort Yates	63	−24
Do	Tobacco Garden	27	−35			
Delaware	Del. Breakwater	55	14			
District of Columbia	Washington	54	8			
Florida	Key West	81	52	Fort Barrancas	79	15
Do	Pensacola	71	25			
Georgia	Savannah	72	26	Forsyth	68	18
Do	Atlanta	64	12	Quitman	74	22
Idaho	Boisé City	58	−4			
Do	Eagle Rock	50	−26			
Indiana	Indianapolis	57	−10	Irvington	57	−10
Do				Miami	57	−11
Do				Rushville	46	−17
Do				Lafayette	44	−17
Illinois	Cairo	56	4	Bunker Hill	56	−11
Do	Champaign	49	−14	Elmira	43	−18
Indian Territory	Fort Supply	69	5			
Do	Fort Sill	66	10			
Iowa	Keokuk	52	−10	Logan	54	−16
Do	Des Moines	50	−17	Cresco	38	−23
Kansas	Leavenworth	59	−5	Clay Centre	68	−14
Kentucky	Louisville	56	4	Frankfort	51	0
Louisiana	New Orleans	76	30	Point Pleasant	75	19
Do	Shreveport	72	22			
Maine	Eastport	49	5	Orono	47	−12
Do	Portland	49	9	Gardiner	45	−9
Maryland	Baltimore	51	10	Emmittsburg	50	2
Do				Cumberland	48	4
Massachusetts	Boston	54	6	Williamstown	43	−5
Do	Provincetown	54	16	Rowe	46	−8
Michigan	Detroit	50	2			
Do	Escanaba	41	−12			
Minnesota	Saint Vincent	27	−30	Northfield	35	−18
Do	Moorhead	36	−29	Fort Snelling	34	−28
Mississippi	Vicksburg	70	19	Fayette	70	20
Do	Starkville	68	13			
Missouri	Springfield	62	−4	Protem	68	5
Do	Saint Louis	60	−6	Oregon	61	−16
Do				Sedalia	62	−13
Montana	Fort Benton	57	−26			
Do	Fort Shaw	57	−17			
Do	New Chicago	55	−34			
Nebraska	North Platte	67	−7	Fort Niobrara	57	−21
Do	Omaha	57	−15			
Nevada	Winnemucca	60	−4	Golconda	73	−3
Do				Halleck	60	−28
New Hampshire	Mt. Washington	32	−25	New Market	53	−1
Do				Grafton	41	−8
New Jersey	Cape May	60	14	New Brunswick	47	2
Do	Sandy Hook	53	3			
New Mexico	Fort Bayard	75	11	Fort Union	66	−10
Do	Santa Fé	55	−1			
New York	New York City	54	11	Johnstown	42	−16
Do	Oswego	43	3	Madison Barracks	42	−8
Do				Friendship	42	−8
North Carolina	Wilmington	68	17	Ore Knob	55	−6
Do	Charlotte	60	10	Highlands	49	3
Ohio	Cincinnati	55	1	Portsmouth	64	0
Do	Cleveland	45	−9	Marion	58	−10
Do				Ruggles	44	−10
Oregon	Umatilla	58	6	Albany	59	26
Do				Fort Klamath	53	0
Pennsylvania	Philadelphia	54	14	Franklin	40	−10
Do	Pittsburg	50	−1.5	Blooming Grove	46	−9
Rhode Island	Narragansett Pier	54	5			
South Carolina	Charleston	69	24	Aiken	66	16
Tennessee	Memphis	67	12	Murfreesboro	57	4
Do	Knoxville	60	5			
Texas	Uvalde	87	25			
Do	Fort Elliott	75	1			
Utah	Salt Lake City	60	12			
Vermont				Woodstock	42	−24
Virginia	Norfolk	59	16	Johnsontown	61	14
Do	Lynchburg	59	8	Snowville	50	0
Washington	Almota	68	16			
Do	Colfax	50	−5			
West Virginia	Morgantown	52	3	Helvetia	58	−8
Wisconsin	Milwaukee	36	−13	Evansville	51	−13
Do	La Crosse	39	−20	Embarrass	34	−28
Wyoming	Cheyenne	58	−15	Fort Bridger	50	−18
Do	Fort Washakie	52	−27	Fort Washakie	50	−35

Northern plateau.—From 18° at Lewiston, Idaho, on the 16th, to 36° at Eagle Rock, Idaho, on the 31st.

Middle Pacific coast region.—From 14° at San Francisco, California, on the 3d and 4th, to 30° at Red Bluff, California, on the 4th.

South Pacific coast region.—From 26° at San Diego, California, on the 27th, to 39° Los Angeles, California, on the 15th.

FROSTS.

In the various districts they were reported on the following dates:

New England.—1st to 5th, 7th to 31st.

Middle Atlantic states.—1st to 5th, 7th to 21st, 23d to 31st.

South Atlantic states.—1st to 5th, 7th to 12th, 14th, 16th to 21st, 24th, 25th, 27th, 28th, 30th, 31st.

East Gulf states.—1st to 4th, 8th, 9th, 11th, 12th, 16th, 17th, 18th, 23d to 31st.

West Gulf states.—1st, 2d, 3d, 6th, 7th, 8th, 10th, 11th, 13th, 14th, 16th, 17th, 18th, 21st to 31st.

Rio Grande valley.—1st, 2d, 8th, 11th, 13th, 16th, 17th, 23d, 28th, 29th, 30th.

Tennessee.—1st to 4th, 6th to 9th, 11th, 12th, 14th to 19th, 23d to 31st.

Ohio valley.—1st to 19th, 22d to 31st.

Lower lake region.—12th, 18th, 19th, 20th, 25th, 26th, 27th, 29th, 30th, 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—1st to 31st.

Upper Mississippi valley.—1st to 31st.

Missouri valley.—1st, 2d, 3d, 6th, 7th, 8th, 10th to 19th, 22d to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 8th, 10th to 19th, 21st, 22d, 23d, 25th, 27th to 31st.

Southern slope.—1st, 2d, 3d, 5th, 6th, 8th to 11th, 13th to 18th, 22d, 23d, 25th to 30th.

Southern plateau.—1st to 31st.

Middle plateau.—1st to 8th, 10th, 15th, 16th, 21st, 22d, 24th, 26th to 21st.

Northern plateau.—1st, 2d, 5th, 7th, 9th to 12th, 14th, 15th, 16th, 18th, 19th, 20th, 23d, 25th to 31st.

North Pacific coast region.—11th, 13th, 18th, 19th, 23d, 25th, 26th, 28th to 31st.

Middle Pacific coast region.—3d to 10th, 15th to 18th, 20th, 25th, 26th, 27th, 29th, 30th, 31st.

South Pacific coast region.—3d, 5th, 10th, 11th, 13th to 16th, 19th, 20th, 22d to 31st.

The occurrence of frosts has also been reported by the following stations not situated in the districts named above: Cedar Keys, Florida, 1st, 2d, 8th, 17th; Fort Brooke, Florida, 1st, 2d.

At New Orleans, on the 8th, considerable damage was done by the freeze, to the sugar-cane in some of the parishes.

At Mayport, Florida, the orange crop was injured by the freeze of the 17th.

ICE.

The subject of the formation of ice in the northern sections, is considered elsewhere in the REVIEW, under the heading ICE IN RIVERS AND HARBORS. The following are exceptional cases of ice formation in the southern sections of the country.

Alabama.—Mobile, 1st, 8th, 9th, 17th, 30th; Auburn, 1st, 8th, 9th, 16th, 17th, 18th.

Florida.—Jacksonville, 8th, 17th, 18th; Pensacola, 8th; Mayport, 12th, 17th, 18th.

Georgia.—Atlanta, 7th, ice sufficiently thick to bear the weight of persons on the ponds in vicinity. Savannah, 1st, 8th; Augusta, 8th, 9th, 16th, 17th, 18th.

Louisiana.—New Orleans, 8th.

North Carolina.—Kittyhawk, 9th, bay frozen. Cape Lookout, 9th. Core Sound frozen for a distance of one hundred yards from the shore, with ice one-half inch in thickness.

South Carolina.—Charleston, 17th.

Tennessee.—Memphis, 1st, 3d, 7th, 8th, 15th; Chattanooga, 1st, 4th, 7th, 8th, 9th, 12th, 16th, 17th, 18th, 24th, 25th.

Texas.—Indianola, 8th, the water in the bay sufficiently cold to kill fish, numbers of which were picked up along the shore. Ice formed on the 8th and 16th. Palestine, 7th, 8th, 16th; Fredericksburg, 7th, 8th, 16th, 29th, 31st; Eagle Pass, 16th, 17th, 18th, 23d, 29th, 30th; Uvalde, 8th.

PRECIPITATION.

(*Expressed in inches and hundredths.*)

The distribution of rainfall over the United States and Canada, as determined from observations taken at more than five hundred stations, is exhibited on chart iii. The table in the lower left-hand corner of this chart shows the average monthly rainfall, determined from the records of Signal Service stations, in the several districts; it shows also the excess or deficiency of precipitation as compared with the average of many years.

A very large excess of rainfall (6.86) is reported from the north Pacific coast region. In the northern plateau, northern slope, the lake region, south Atlantic states, and in Florida, excesses are reported varying from 0.06 to 0.45. In all the other districts, the rainfall is below the December average. The largest deficiencies are: Middle Pacific coast region, 4.14; Tennessee, 2.90; Ohio valley, 1.80; south Pacific coast region, 1.44; east Gulf states, 1.20.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the left-hand of chart iii.

The Chief Signal Officer is indebted to voluntary observers for the following interesting items bearing upon this subject. These comparisons are of special importance, as many of the records from which they are made cover long periods, some extending back many years before the establishment of the Signal Service:

Illinois.—Riley, monthly precipitation, 2.00, is 0.07 above the December average of twenty-one years. The total precipitation for the year of 1882 is 35.36, or 1.46 above the annual average of twenty-one years.

Indiana.—Logansport, monthly precipitation, 3.14, is 0.70 above the December average since 1860. The depth of snowfall for December, 1882, is 13.30 inches, or 4.48 above the average for December. During December, 1862, no snow fell; the greatest depth of snow for December, 24.11 inches, fell in 1872. In 1876, no rain fell during December; the largest December precipitation, 5.99, occurred in 1881. Vevay, monthly precipitation, 2.85, is 1.38 below the December average.

The following tables showing the monthly and annual rainfalls with the monthly and annual averages; and the rainfall by seasons, from 1866 to 1882, at Laconia, Indiana, have been furnished by Mr. Adam Crozier, of that place:

Table showing Monthly and Annual Rainfall at Laconia, Indiana.

Months.	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	Monthly averages.
January	4.47	1.69	4.75	2.35	6.89	2.59	0.83	3.05	2.36	1.83	10.10	3.65	3.55	2.89	4.53	2.58	6.88	3.83
February	1.36	8.96	1.75	2.45	2.40	6.55	3.59	4.40	4.71	1.37	2.46	0.41	2.88	2.52	6.19	3.98	9.13	3.83
March	7.53	5.95	4.64	4.74	3.81	7.32	1.83	2.56	5.69	6.33	6.18	3.95	4.41	4.94	4.80	3.51	4.52	4.86
April	2.14	2.95	5.93	5.42	2.78	2.10	8.21	2.61	5.01	1.57	3.89	5.36	3.09	3.92	6.46	3.48	1.99	3.93
May	1.22	3.61	8.08	3.30	6.50	5.33	3.68	5.68	2.10	3.73	1.24	2.12	3.29	1.28	2.78	3.45	7.86	3.84
June	5.02	2.85	2.78	2.94	2.06	1.43	2.46	5.06	0.98	8.60	7.67	5.31	3.96	1.20	3.22	7.19	5.75	4.02
July	2.79	6.37	3.74	2.32	3.80	3.22	3.39	5.66	1.65	9.97	4.18	4.26	3.07	1.18	4.00	1.81	5.57	3.94
August	3.57	1.11	3.67	4.23	4.71	4.95	5.18	3.54	3.21	1.89	3.97	1.89	1.96	6.24	2.07	0.71	6.18	3.44
September	7.76	1.82	5.92	2.54	2.33	2.05	2.45	1.52	0.66	0.34	2.45	3.44	1.52	5.94	2.61	3.97	3.95	3.02
October	1.65	0.76	1.41	2.32	2.86	2.64	2.25	4.24	1.58	1.64	4.53	1.94	2.41	0.61	7.20	4.03	3.64	2.69
November	3.71	3.42	1.95	5.09	2.26	2.29	1.01	2.02	4.75	5.73	1.85	3.83	4.09	4.07	3.63	2.48	2.34	3.21
December	2.04	4.54	4.03	2.87	2.74	3.69	2.36	3.92	4.75	4.75	1.42	3.24	5.26	8.21	2.55	4.69	2.23	3.73
Annual sums	43.26	44.03	48.05	40.63	43.14	44.16	37.34	44.26	37.45	47.75	49.94	39.40	39.49	43.00	50.06	41.88	60.04	44.34
Monthly averages	3.60	3.67	4.00	3.39	3.59	3.68	3.11	3.69	3.12	3.98	4.16	3.28	3.29	3.58	4.18	3.49	5.00	3.70

Table showing Rainfall by Seasons, at Laconia, Indiana.

SEASONS.	1865-6.	1866-7.	1867-8.	1868-9.	1869-70.	1870-1.	1871-2.	1872-3.	1873-4.	1874-5.	1875-6.	1876-7.	1877-8.	1878-9.	1879-80.	1880-1.	1881-2.	Mean.
Winter	12.78	12.69	11.04	8.86	12.16	11.88	8.21	9.81	10.99	7.95	17.31	5.48	9.67	10.67	18.95	9.11	20.70	11.66
Spring	10.89	12.51	16.65	10.49	13.09	14.75	13.72	10.85	12.80	11.63	11.31	11.43	10.79	10.14	14.04	10.44	14.37	12.64
Summer	11.48	10.33	9.59	9.49	10.57	9.60	11.03	14.26	5.84	20.46	15.82	11.46	8.99	8.62	9.29	9.71	17.50	11.41
Autumn	13.12	6.00	9.28	9.95	7.45	6.98	5.71	7.78	6.99	7.71	8.83	9.21	8.02	10.62	13.44	10.48	9.93	8.91
Total for the year	48.17	41.53	48.56	41.79	43.27	43.21	38.67	42.70	36.62	47.75	53.27	37.58	37.47	40.05	55.72	39.74	62.50	44.62

The following table, furnished by Dr. T. C. Hunter, of Wabash, Indiana, shows the monthly and annual precipitation at that place for the six years ending December 31, 1882:

MONTH.	1877.	1878.	1879.	1880.	1881.	1882.	Monthly averages.
January	1.29	1.76	1.47	3.41	1.07	1.70	1.78
February	0.02	3.57	1.13	1.96	4.47	3.98	2.52
March	5.22	2.29	4.06	2.58	2.27	2.94	3.23
April	1.58	2.92	1.96	4.74	1.19	4.32	2.78
May	1.38	4.47	2.46	8.86	1.34	4.63	3.86
June	6.14	2.15	4.42	5.74	5.71	5.25	4.90
July	2.76	3.28	3.48	1.18	2.69	4.26	2.93
August	3.10	4.33	1.39	5.47	0.55	4.97	3.30
September	0.90	3.02	4.54	1.28	3.79	0.39	2.32
October	4.58	2.44	0.75	1.44	6.96	3.03	3.20
November	3.44	2.51	4.28	2.27	4.73	3.08	3.38
December	0.85	2.89	3.78	1.16	5.87	1.77	2.72
Sums	31.21	35.63	33.72	40.09	40.94	40.32	36.92
Means	2.60	2.97	2.81	3.34	3.41	3.36	3.08

Iowa.—Iowa city, the following extract is taken from "Press Bulletin," number 116, for December, 1882, published by Dr. Gustavus Hinrichs, Director of the Iowa Weather Service:

* * * The total precipitation was about 30 per cent. above the normal throughout the state; it averaged one inch in the west and two inches in the the east. * * * * *

Kansas.—Wellington, monthly precipitation, 0.67, is about the December normal. The total precipitation for the year 1882 is 36.00, or 6.79 above the annual average of four years. The snowfall for 1882 is 15.5 inches, or 5 inches above the annual average. Yates Centre, monthly precipitation, 3.35, is 0.46 above the December average of the last three years. Lawrence, monthly precipitation, 1.24, is 0.41 below the December average of the last fifteen years. During that period, the largest monthly precipition, 4.39, occurred in 1873; the smallest, 0.43, occurred in 1876 and 1880. The following table is compiled from the annual summary prepared by Professor F. H. Snow, of the State University, Lawrence, Kansas, and is interesting as showing the annual rainfall (including melted snow); the annual snowfall; the total number of days on which rain or snow fell; with the percentages of mean relative humidity and mean cloudiness, for each year from 1868 to 1882, inclusive:

Year.	Annual rainfall.	Annual snowfall.	Number of rainy days.	Relative humidity.	Mean cloudiness.
				Percentages.	*Percentages.*
1868	37.48	27.50	77	.....	48.35
1869	38.51	18.00	105	78.2	49.23
1870	31.32	9.50	100	68.4	47.88
1871	33.23	29.75	120	65.9	47.37
1872	32.63	23.25	116	64.4	44.33
1873	32.94	26.00	101	64.0	42.46
1874	28.87	43.00	99	65.7	45.54
1875	28.87	5.00	106	66.7	44.81
1876	44.18	24.75	102	66.8	41.27
1877	41.09	15.50	126	72.6	47.12
1878	38.39	25.50	107	70.2	40.65
1879	32.68	10.35	90	67.1	40.01
1880	32.65	7.00	89	67.9	40.15
1881	33.27	32.50	110	70.1	47.52
1882	27.60	18.00	102	68.6	45.41
Means of 15 years	34.25	21.07	103	68.3	44.40

Maine.—Gardiner, monthly precipitation 3.53, or 0.25 below the December average of a period of forty-six years. The precipitation for the year 1882 is 41.77, or 2.43 below the annual average; the total precipitation for the three months ending December 31, 1882, is but little more than one-half of the average of the corresponding months in previous years.

Maryland.—Fallston, monthly precipitation, 1.48, is 1.78 below the December average of the last thirteen years. During that period, the largest December precipitation, 7.02, occurred in 1878; the smallest, 1.27, occurred in 1873. The total precipitation for the year 1882 is 42.99, or 3.22 below the annual average of twelve years. The total precipitation for the three months ending December 31, 1882, is only 2.72.

Missouri.—The Missouri Weather Service reports the monthly precipitation at Saint Louis to be 1.75, which is 1.22 below the average for December.

New Hampshire.—Grafton, monthly precipitation, 2.32, is 2.18 below the December average of the last three years. Antrim, monthly precipitation, 2.45, is 1.13 below the December average of the last ten years.

New York.—North Volney, monthly precipitation, 3.35, is 0.06 below the December average of eleven years. During that period, the largest December precipitation, 8.35, occurred in 1878; the smallest, 1.80, occurred in 1875. The total precipitation for the year 1882, 29.90, is 6.72 below the annual average of a period of ten years. The largest annual precipitation of that period was 48.35, in 1878; the smallest, 29.90, in 1882. Rain or snow fell on one hundred and eighty-two days during the year, which is seven days less than for any year during the period covered by the record. Palermo, monthly precipitation, 3.51, is 0.50 below the December average of twenty-nine years. The largest December precipitation of that period, 7.90, occurred in 1878; the smallest, 1.60, occurred in 1874. The total snowfall for December, 1882, is twenty-six inches, or eight inches more than the December average of the last twenty-nine years. During that period, the largest December snowfall, sixty-eight inches, occurred in 1868; the least, four inches, fell in 1881. The total snowfall for the year 1882 is fifty inches, or forty-seven inches below the annual average. In 1856, snow fell to a depth of one hundred and eighty-five inches, being the largest annual snowfall; the least is that for 1882.

Virginia.—Wytheville, monthly precipitation, 2.45, is below the December average of a period of seventeen years. The total precipitation for the year 1882 is 8.69 above the annual average, and has been exceeded only in 1861 and 1878, when the amounts were 51.00 and 52.50, respectively.

The following table, furnished by Mr. C. R. Moore, of Snowville, Virginia, shows the precipitation for each month and year, from January, 1869, to December, 1882, with the monthly and annual averages:

MONTH.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	Monthly average.
January	4.55	2.65	2.30	2.00	4.20	2.50	5.00	1.00	3.40	4.40	3.40	1.05	4.45	6.75	3.404
February	3.00	3.15	4.00	4.80	6.05	4.20	3.85	3.85	1.40	1.10	2.90	2.40	3.65	4.80	3.475
March	2.80	3.25	6.65	5.25	1.70	3.80	7.10	4.30	5.15	4.60	4.40	6.35	5.65	3.95	4.582
April	1.10	3.00	3.20	3.00	1.95	6.15	3.05	3.75	4.50	5.10	2.25	1.35	4.15	2.35	3.207
May	4.75	5.75	2.90	3.20	5.55	3.90	2.45	3.70	2.60	4.65	0.50	1.45	0.70	3.80	3.279
June	3.80	3.20	4.15	2.85	1.45	2.90	4.25	3.30	2.40	2.80	2.30	4.60	8.15	1.00	3.368
July	3.85	3.40	5.00	3.95	1.25	4.90	6.50	4.85	8.90	2.30	3.30	6.25	7.00	2.85	4.593
August	0.20	0.45	5.30	1.20	2.80	1.80	11.25	2.00	1.70	6.80	10.85	10.00	2.40	4.10	4.354
September	2.20	1.65	4.70	1.45	4.40	4.25	3.95	7.70	5.00	1.10	2.85	1.95	0.95	4.45	3.286
October	3.75	2.55	4.10	9.25	5.25	0.05	2.55	1.25	5.10	3.55	0.90	2.25	2.50	4.75	3.414
November	2.25	2.00	4.70	3.40	3.85	2.15	3.45	4.60	3.85	2.80	0.40	5.10	4.50	1.00	3.146
December	2.55	2.15	2.20	6.35	4.20	3.80	2.90	1.70	2.40	5.25	4.50	6.75	1.85	4.75	3.668
Annual sums	34.50	32.60	49.20	46.70	42.65	40.50	56.30	41.40	46.40	44.45	38.55	49.50	45.35	44.55	43.761
Monthly average	2.88	2.72	4.10	3.89	3.55	3.38	4.69	3.45	3.87	3.70	3.21	4.11	3.78	3.71	3.647

Table of Excessive, Greatest and Least Monthly Rainfalls.

STATION.	SPECIAL HEAVY. Date.	Amt.	Duration	Largest Monthly. Amount.	SMALLEST MONTHLY. STATION.	Amt.
Alabama.					*Arizona.*	
Mount Vernon Barracks	19	3.60			Casa Grande	0.00
Mobile	20, 21	2.90			Maricopa	0.00
Florida.					Pantano	0.00
Fort Barrancas	21	2.20		7.25	Phœnix	0.00
Do	10	1.15	3 h.		Prescott	0.00
Pensacola	21, 22	2.30		6.12	Texas Hill	0.00
Georgia.					Yuma	0.00
Fort Quitman	13	2.71		6.62	Tucson	0.04
Idaho.					Fort Verde	0.07
Lewiston					Fort Apache	0.08
Mississippi.					Fort Lowell	0.12
Vicksburg	19	3.70			Benson	0.15
Fayette	19	2.60			San Simon	0.20
North Carolina.					Willcox	0.32
Hatteras	29, 30	3.15		6.86	Fort Bowie	0.35
Kittyhawk	30	2.57			Camp Thomas	0.46
Oregon.					*California.*	
Portland	12, 13	10.75		20.14	Anaheim	0.00
Eola	12, 13	3.68		9.76	Delano	0.00
Fort Stevens				9.26	Lemore	0.00
Albany	13	3.27			Mammoth Tank	0.00
Texas.					Mojave	0.00
Galveston	18, 19	2.72			Indio	0.00
Virginia.					Ravenna	0.00
Norfolk	30	2.48		6.09	San Fernando	0.00
Cape Henry	30, 31	2.57			Solidad	0.00
Chincoteague	10	2.48			Spadra	0.00
Washington Territory.					Sumner	0.00
Fort Canby				12.46	White Water	0.00
Bainbridge Island				7.35	Kingsburg	0.03
Dayton	13	3.69		7.12	Borden	0.07
Colfax				6.42	Merced	0.07
					Goshen	0.08
					Los Angeles	0.08
					Modesto	0.12
					San Diego	0.13
					Visalia	0.15
					Tennant	0.20
					Tracy	0.20
					Gilroy	0.21
					Crafton	0.25
					Galt	0.25
					Ione	0.25
					San Jose	0.25
					Poway	0.27
					Stockton	0.27
					Byron	0.32
					Williams	0.33
					Knight's Landing	0.34
					Caliente	0.37
					Lathrop	0.37
					Livermore	0.38
					Monterey	0.39
					Martinez	0.46
					Keene	0.47
					Willows	0.49
					Tehachapi	0.50
					Colorado.	
					West Las Animas	0.08
					Pagoda Springs	0.40
					Pike's Peak	0.44
					Dakota.	
					Fort Bennett	0.05
					Fort Sully	0.06
					Fort Yates	0.06
					Fort Hale	0.11
					Fort Meade	0.12
					Huron	0.23
					Alexandria	0.25
					Wicklow	0.26
					Fort Buford	0.27
					Rapid City	0.40
					Fort Totten	0.40
					Bismarck	0.43
					Morriston	0.50
					Indian Territory.	
					Fort Supply	0.03
					Fort Sill	0.33
					Kansas.	
					Salina	0.03
					Pretty Prairie	0.50
					Montana.	
					Fort Keogh	0.74
					Fort Shaw	0.37
					Helena	0.48
					Nevada.	
					Terrace	0.10
					Wadsworth	0.20
					Beowanee	0.23
					Kelton	0.23
					Golconda	0.25
					Battle Mountain	0.30
					Halleck	0.30
					Carson City	0.34
					Corinne	0.40
					Carlin	0.45
					Blue Creek	0.50
					New Mexico.	
					Fort Bayard	t'ce
					Fort Union	0.16
					Deming	0.20
					Lordsburg	0.20
					New Jersey.	
					Phillipsburg	0.45

Table of Excessive, Greatest and Least Monthly Rainfalls.—Continued.

STATION.	SPECIAL HEAVY. Date.	Amt.	Duration	Largest Monthly. Amount.	SMALLEST MONTHLY. STATION.	Amt.
					New York.	
					Friendship	0.35
					Texas.	
					El Paso	0.00
					Fort Concho	t'ce
					Brackettville	0.02
					Fort Davis	0.02
					Henrietta	0.06
					Eagle Pass	0.09
					Uvalde	0.17
					Fort Stockton	0.22
					Fort Elliott	0.40
					Wyoming.	
					Cheyenne	0.10
					Fort Bridger	0.38

The following table shows the greatest and least numbers of rainy and cloudy days, and percentages of mean relative humidity, as reported from the various districts:

Table of rainy and cloudy days and relative humidity for December, 1882.

Districts.	Rainy days	Cloudy days.	Relative humidity. *
			Percentages.
New England	From 8 to 20	From 5 to 11	From 67.4 to 84.2
Middle Atlantic states	" 7 " 21	" 2 " 15	" 60.1 " 77.9
South Atlantic states	" 9 " 17	" 4 " 11	" 65.1 " 83.8
Florida peninsula	" 7 " 11	" 3 " 11	" 76.9 " 83.2
East'n Gulf states	" 8 " 14	" 5 " 10	" 66.7 " 77.0
Western Gulf states	" 5 " 15	" 3 " 8	" 62.0 " 79.3
Rio Grande valley	" 1 " 11	" 4 " 8	" 56.8 " 78.7
Ohio valley and Tennessee	" 10 " 21	" 7 " 19	" 64.1 " 76.0
Lower lake region	" 19 " 26	" 17 " 27	" 71.1 " 86.7
Upper lake region	" 16 " 27	" 12 " 29	" 72.6 " 87.0
Extreme northwest	" 5 " 14	" 5 " 11	" 67.1 " 89.1
Upper Mississippi valley	" 12 " 21	" 13 " 16	" 65.7 " 85.4
Missouri valley	" 7 " 12	" 7 " 11	" 61.2 " 76.3
Northern slope	" 3 " 13	" 4 " 11	" 47.4 " 77.9
Middle slope	" 1 " 10	" 1 " 4	" 52.3 " 77.8
Southern slope	" 1 " 6	" 0 " 5	" 55.5 " 69.8
Southern plateau	" 0 " 7	" 0 " 2	" 48.8 " 61.7
Middle plateau	" 4 " 12	" 2 " 11	" 49.9 " 71.4
Northern plateau	" 8 " 17	" 7 " 21	" 74.1 " 85.5
North Pacific coast region	" 20 " 24	" 16 " 21	" 82.7 " 85.5
Middle Pacific coast region	" 7 " 8	" 2 " 5	" 75.8 " 82.6
South Pacific coast region	" 0 " 5	" 0 " 1	" 39.2 " 78.0

* Relative humidity corrected for altitude.

HAIL.

The dates on which hail storms occurred in the various states and territories are as follows:

Connecticut.—New Haven, 3d.

Dakota.—Fort Lincoln, 3d, 8th.

Georgia.—Atlanta, 7th, 20th.

Kansas.—Yates Centre, 6th, 31st.

Montana.—Fort Maginnis, 8th.

North Carolina.—Hatteras, 3d; Lenoir, 26th; Weldon, 29th, 30th.

Pennsylvania.—Catawissa, 10th; Grampian Hills, 13th; Dyberry, 21st.

Tennessee.—Austin, 20th.

Washington Territory.—Fort Canby, 19th.

SNOW.

The dates on which snow fell in the various districts are as follows:

New England.—1st to 31st.

Middle Atlantic states.—2d to 5th, 7th, 8th, 10th, 11th, 13th, 15th to 21st, 23d, 26th to 30th.

South Atlantic states.—3d, 15th to 20th, 27th to 30th.

Tennessee.—15th, 17th, 28th, 29th, 30th.

Ohio valley.—2d, 3d, 5th, 6th, 7th, 9th to 18th, 22d to 29th, 31st.

Lower lake region.—1st to 28th, 30th, 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—1st to 13th, 16th to 21st, 25th, 27th, 29th, 30th.

Upper Mississippi valley.—1st to 31st.

Missouri valley.—1st, 4th, 5th, 6th, 8th, 9th, 10th, 12th to 15th, 18th to 21st, 23d to 26th, 28th to 31st.

Northern slope.—1st, 4th to 25th, 26th to 30th.

Middle slope.—6th to 9th, 14th, 15th, 18th to 27th, 29th, 30th, 31st.

Southern slope.—18th, 21st, 22d, 24th, 26th, 27th, 30th, 31st.

Southern plateau.—7th, 19th, 20th, 21st, 23d, 27th, 30th, 31st.

Middle plateau.—6th, 8th, 9th, 11th to 20th, 23d, 25th, 29th, 30th, 31st.

Northern plateau.—6th to 14th, 17th to 25th, 27th, 28th, 29th.

Snow also fell in the following states and territories not included in the districts named above:

Alabama.—Auburn, 15th; Montgomery, 29th.

Arkansas.—Fort Smith, 15th, 29th, 31st; Little Rock, 15th, 31st.

California.—Fort Bidwell, 10th, 18th to 22d, 24th, 28th, 29th; Sacramento, 31st; San Francisco, 31st; Visalia, 31st.

At Oakwood, California, on the 12th, snow fell throughout the day, reaching a depth of about four inches on the level. This is the first snowfall occurring at this station during the observer's residence of several years; and no authentic precedent has been heard of. Great damage was done to timber, especially to live-oaks. The evergreen foliage being overloaded with snow, an immense number of limbs and many whole trees were broken down, obstructing travel.

Louisiana.—Point Pleasant, 22d.

Mississippi.—Agricultural College, 15th.

Washington Territory.—12th, 17th to 20th, 23d, 28th, 29th.

LARGEST MONTHLY SNOWFALLS.

[*Expressed in inches.*]

The following are the largest monthly snowfalls reported from the various states and territories during the month:

California.—Summit, 49.5; Emigrant Gap, 30; Cisco, 28.75; Alta, 7; Oakland, 4.

Colorado.—Denver, 7.5; Pike's Peak, 4.5.

Connecticut.—New London, 4.

Dakota.—Fort Randall, 22; Fort Stevenson, 7; Yankton, 7; Morriston, 4; Bismarck, 3.75.

Idaho.—Eagle Rock, 12.

Illinois.—Riley, 12; Springfield, about 10; Morrison, 8.75; Rockford, 8.5; Charleston, 7; Bunker Hill, 6; Mattoon, about 5; Peoria, 3.5.

Indiana.—Logansport, 13 25; Fort Wayne, 9.25; Wabash, 7.25; Lafayette, 6.5; New Harmony, 5.

Iowa.—Des Moines, 23; Logan, 21; Independence, 15.5; Indianola, 15; Dubuque, 13; Humboldt, 11; Monticello, 10.75; Ames, 8.75; Cedar Rapids, 7.5; Cresco, 7.5; Clinton, 7.25; Fort Madison, 7; Keokuk, 4.5; Muscatine, 4.

Kansas.—Lawrence, 5; Leavenworth, about 5; Creswell, 4.50; Holton, 4; Yates Centre, 3.5; Salina, 3.

Kentucky.—Bowling Green, 3; Frankfort, 3.

Maine.—Dexter, 29; Cornish, 27; Gardiner, 22; Orono, 21; Portland, about 13; Eastport, about 8.

Massachusetts.—Provincetown, about 15; Rowe, 11.5; Westborough, 8; Milton, 7; Princeton, 6.75; Charleston, 6.5; Dudley, 6.25; Springfield, about 6; Boston, 4.25; Menden, 4.

Michigan.—Traverse City, 47; Northport, 40; Mackinac City, 36.5; Marquette, about 25; Port Huron, 21.5; Alpena, 21.25; Harrisville, 20; Escanaba, 15.5; Thornville, 12.5; Battle Creek, 11.5; Litchfield, 11.25; Hillsdale, 10.5; Hastings, 10; Marshall, 9.25; Detroit, about 9.

Minnesota.—Northfield, 26; Minneapolis, 20; Moorhead, 13.75; Duluth, 11; Saint Paul, 7.5; Saint Vincent, 7.25.

Missouri.—Corning, 12.

Montana.—Fort Assinniboine, 13.5; Fort Custer, 12; Fort Benton, 10; Helena, 4.75; Fort Shaw, 4.75.

Nebraska.—Clear Creek, 13.5; De Soto, 9; Genoa, 8; Ord, 7.25; North Platte, 6.5; Omaha, about 4.

Nevada.—Otego, 14; Wells, 11; Fort McDermitt, 10.75; Truckee, 8; Elko, 7; Palisade, 6.75; Boca, 6; Humboldt, 5.5; Tecoma, 4; Winnemucca, 3.5.

New Hampshire.—Ashland, about 35; Woodstock, about 35; Bristol, about 28; Mount Washington, 26.5; Wier's Bridge, about 25; Wolfborough, about 25; Lake Village, 20.75; Belmont, about 20; Grafton, 19; Antrim, 11.50; New Market, 8.25.

New Mexico.—Santa Fé, 5.50.

New York.—Oswego, about 45; Palermo, 26; Friendship, 18; Madison Barracks, 14.50; Rochester, 14; Ithica, 13; Buffalo, 10.50; Albany, 9.50; Port Jervis, 8.50; Johnstown, 8; Cooperstown, 7; Elmira, 5.50; Factoryville, 4.75; Ardenia, 4; Penn Yan, 4.

North Carolina.—Highlands, 12; Ore Knob, 10; Kittyhawk, 5.

Ohio.—Cleveland, 16; Ruggles, 9; Marion, 7; Sandusky, 6; North Lewisburg, 5.25; Toledo, 5.25; College Hill, 4.50; Jacksonburg, 4; Westerville, 3.25; New Athens, 3.

Pennsylvania.—Erie, 16.75; Grampian Hills, 14.75; Dyberry, 7.50; Wellsboro', 7; Pittsburg, about 6; Williamsport, 6; Chambersburg, 4.

Rhode Island.—Newport, about 5.

Tennessee.—Austin, 3.

Utah.—Salt Lake City, about 6.50; Promontory, 6; Ogden, 4.25; Corinne, 4; Blue Creek, 4.

Vermont.—Charlotte, 33; Woodstock, 32; Newport, 31; Strafford, 29; Lunenburg, 24.

Virginia.—Variety Mills, 10.25; Wytheville, 8.

West Virginia.—Helvetia, 13.

Wisconsin.—Embarrass, 23.75; Madison, 20; Ripon, 15.75; Franklin, 10.50; Beloit, 8.75; Manitowoc, 8.

Wyoming.—Fort Washakie, 5.25.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[*Expressed in inches.*]

Arkansas.—Fort Smith, 0.75; Mount Ida, trace.

California.—San Francisco, 2.00.

Colorado.—Pike's Peak, 4.00; Denver, 1; West Las Animas, trace.

Dakota.—Bismark, 4.00; Alexandria, 2.00; Fort Stevenson, 1.50; Huron, 1.50; Wicklow, 1.25; Morriston, 1.00; Fort Bennet, trace; Yankton, trace.

Idaho.—Boisé City, 5; Lewiston, 3.50; Eagle Rock, 3.25.

Illinois.—Riley, 4; Morrison, 1.50; Bunker Hill, 1.00; Champaign, 0.50; Charleston, 0.50; Chicago, trace; Springfield, trace.

Indiana.—Lafayette, 2.00; Fort Wayne, 1.00; Indianapolis, 0.50.

Indian Territory.—Fort Sill, 2.00.

Iowa.—Humboldt, 6.00; Cresco, 5.00; Independence, 4.00 to 12.00; Indianola, 4.00 to 6.00; Ames, 4.50; Cedar Rapids, 3.00; Des Moines, 3.00; Monticello, 3.00; Guttenberg, 2.50; Dubuque, 2.00; Keokuk, 0.75; Clinton, trace.

Kansas.—Independence, 1.50; Leavenworth, 1.00; Yates Centre, 1.00; Wellington, 0.75; Creswell, 0.50; Holton, trace.

Kentucky.—Frankfort, 3.00.

Maine.—Gardiner, 14.00; Orono, 12.00; Eastport, 7.00; Portland, 3.00.

Massachusetts.—Rowe, 10.00; Williamstown, 5.00; Westborough, 3.00; Menden, 1.00; Springfield, trace.

Michigan.—Northport, 24.00; Marquette, about 12.00; Mackinac City, 8.00; Hastings, 6.00; Hillsdale, 3.50; Escanaba, 3.00; Grand Haven, 2.50; Litchfield, 1.50; Alpena, 1.00; Lansing, 0.50; Port Huron, trace.

Minnesota.—Saint Paul, 11.00; Moorhead, 10.00; Duluth 6.00; Saint Vincent 5.00.

Missouri.—Corning, 4.00; Protem, 3.25; Springfield, 1.50; Pierce City, 1.00; Bedford, 0.50; Saint Louis, trace.

Montana.—Fort Custer, 9.00; Fort Benton, 6.00; Fort Keogh, 5.00; Fort Assinniboine, 4.00; Fort Shaw, 3.75; Fort Missoula, 2.00; Helena, 2.00.

Nebraska.—Clear Creek, 6.00; De Soto, 3.00; Genoa, 3.00; Omaha, 3.00; North Platte, 1.00.

New Hampshire.—Grafton, 15.00; Mount Washington, 12.00; New Market, 4.00.

New Jersey.—South Orange, 1.00; Cape May, 0.33.

New Mexico.—Santa Fé, 3.00 to 12.00.

New York.—Palermo, 17.00; Friendship, 8.00; Johnstown, 8.00; Oswego, 8.00; Cooperstown, 7.00; Albany, 2.00; Buffalo, trace; Ithica, trace.

North Carolina.—Charlotte, 4.00.
Ohio.—Ruggles, 2.00; North Lewisburg, 1.00; Jacksonburg, 1.00; Toledo, 0.50; Westerville, 0.50; Cleveland, trace; Columbus, trace; New Athens, trace.
Oregon.—Umatilla, trace.
Pennsylvania.—Grampian Hills, 8.00; Dyberry, 5.00; Wellsborough, 2.25; Erie, 2.00; Pittsburg, 0.50.
Texas.—Denison, 1.75; Coleman City, 1.25; Jacksborough, 1.00.
Utah.—Salt Lake City, trace.
Vermont.—Charlotte, 24.00; Newport, 20.00; Strafford, 18.00; Woodstock, 14.00.
Virginia.—Lynchburg, 4.00; Variety Mills, 4.00; Wytheville, 2.00; Accotink, trace.
Washington Territory.—Spokane Falls, 2.00.
Wisconsin.—Embarrass, 12.00; Ripon, 8.00; La Crosse, 3.50; Beloit, 2.00; Madison, 0.50; Milwaukee, 0.50.
Wyoming.—Fort Washakie, 3.50; Cheyenne, trace.

SNOW FROM A CLOUDLESS SKY.

Williamsport, Pennsylvania, 26th.—At 3.45 p. m., a heavy snow-storm began, which lasted until 4.30 p. m., after which light snow continued until 6.00 p. m., when the clouds suddenly disappeared, and it continued snowing from a cloudless sky for several minutes.

Huron, Dakota, 10th.—Snow fell from a cloudless sky from 7.00 to 9.00 a. m., presenting a beautiful appearance between the observer and the sun.

SLEET.

Fort Sully, Dakota, 18th.
Fort Totten, Dakota, 16th.
Fort Warren, Massachusetts, 23d.
Fort Assinniboine, Montana, 1st.
West Point, New York, 21st.
Morrison, Illinois, 19th, 20th.
Mattoon, Illinois, 9th.
Yates Centre, Kansas, 26th.
Charlestown, Massachusetts, 11th.
Freehold, New Jersey, 10th.
Vineland, New Jersey, 10th.
Bordentown, New Jersey, 10th.
Lenoir, North Carolina, 20th.
Blooming Grove, Pennsylvania, 21st.
West Chester, Pennsylvania, 10th.
Chambersburg, Pennsylvania, 9th.
Ripon, Wisconsin, 19th.
Portland, Maine, 23d.
New London, Connecticut, 21st.
Burlington, Vermont, 21st, 22d.
Washington, District of Columbia, 13th.
Norfolk, Virginia, 29th.
Albany, New York, 21st, 22d.
Atlantic City, New Jersey, 30th.
Atlanta, Georgia, 19th.
Sloop Point, North Carolina, 28th.
Louisville, Kentucky, 6th.
Columbus, Ohio, 9th.
Nashville, Tennessee, 28th.
Logansport, Indiana, 5th, 20th.
Cleveland, Ohio, 10th.
Toledo, Ohio, 5th, 20th, 27th.
Detroit, Michigan, 31st.
Rochester, New York, 20th.
Buffalo, New York, 10th.
Oswego, New York, 21st.
Mackinac City, Michigan, 19th, 20th.
Grand Haven, Michigan, 1st, 4th, 20th.
Milwaukee, Wisconsin, 2d.
Marquette, Michigan, 19th.
Escanaba, Michigan, 21st.
Chicago, Illinois, 19th, 23d.
Alpena, Michigan, 19th.
Tobacco Garden, Dakota, 3d, 23d.
Dubuque, Iowa, 4th, 19th.
Duluth, Minnesota, 20th.
Madison, Wisconsin, 19th.
Saint Paul, Minnesota, 20th.
Springfield, Illinois, 18th.
Cheyenne, Wyoming, 14th.
Fort McKavett, Texas, 31st.

WINDS.

The prevailing direction of the winds during the month of December, 1882, at Signal Service stations are shown on chart ii. by arrows flying with the wind. In the Southern states the prevailing winds are from the north; in the lower lake region, from the west and southwest; along the Atlantic coast and in the Upper Mississippi and Missouri valleys, they are mostly from the northwest; on the Pacific coast they are variable.

TOTAL MOVEMENTS OF THE AIR.

[*In miles.*]

The following are the largest total movements at the Signal Service stations: On the summit of Mount Washington, New Hampshire, 23,411; Cape May, New Jersey, 12,901; Pike's Peak, Colorado, 12.548; Hatteras, North Carolina, 12,279; Delaware Breakwater, Deleware, 11,809; Kittyhawk, North Carolina, 11,719; Barnegat, New Jersey, 10,573; Block Island, Rhode Island, 10,407; Rochester, New York, 10,087; Port Eads, Louisiana, 10,081; Indianola, Texas, 10,053; Buffalo, New York, 9,948; Galveston, Texas, 9,842; Erie, Pennsylvania, 9,749; Sandy Hook, New Jersey, 9,558; Sandusky, Ohio, 9,474; Fort Shaw, Montana, 9,459; Cape Henry, Virginia, 9,455; Mackinac City, Michigan, 9,397; Champaign, Illinois, 9,096; Milwaukee, Wisconsin, 8,946; Grand Haven, Michigan, 8,757; Oswego, New York, 8,732; Eastport, Maine, 8,545; Moorhead, Minnesota, 8,398; Provincetown, Massachusetts, 8,349; Fort Macon, North Carolina, 8,225; Cleveland, Ohio, 8,167; Newport, Rhode Island, 8,108; Fort Assinniboine, Montana, 8,011. The smallest total movements are: Visalia, California, 1,772; Silver City, New Mexico, 2,156; Fort Missoula, Montana, 2,255; Boisé City, Idaho, 2, 276; Lynchburg, Virginia, 2,284; Lewiston, Idaho, 2,395; Tucson, Arizona, 2,447; Dubuque, Iowa, 2,917.

HIGH WINDS.

Maximum velocities of fifty miles per hour or more have been reported as follows: On the summit of Mount Washington, New Hampshire, 69 nw., 1st; 54, nw., 2d; 72 nw., 3d; 70 sw., 4th; 84 w., 5th; 116 nw., 7th (maximum for month); 98 nw., 8th; 104 nw., 9th; 61 w., 10th; 83 e., 13th; 98 nw., 14th; 72 nw., 15th; 78 nw., 17th; 60 se., 22d; 66 e., 23d; 72 nw., 24th; 52 n., 28th; 68 nw., 29th; 68 nw., 30th; 96 nw., 30th.

On the summit of Pike's Peak, Colorado, 52 w., 1st; 64 nw., 3d; 72 nw., 4th; 62 w., 5th; 60 nw., 6th; 66 nw., 7th; 66 w., 8th; 54 w., 9th; 68 w., 10th; 86 w., 11th, (maximum for month).

Fort Sill, Indian Territory, 56 n., 7th.
Fort Stevenson, Dakota, 52 nw., 3d.
Indianola, Texas, 59 n., 7th.
Cape May, New Jersey, 62 nw., 7th.
Chincoteague, Virginia, 53 nw., 7th.
Kittyhawk, North Carolina, 66 ne., 30th.
Hatteras, North Carolina, 72 n., 30th.
Delaware Breakwater, Delaware, 52 nw., 3d; 57 n., 7th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for December, 1882, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 87.56 per cent. The percentages for the four elements are: Weather, 89.40; direction of the wind, 83.23; temperature, 89.89; barometer, 87.70 per cent. By geographical districts, they are: For New England, 88.2; middle Atlantic states, 87.1; south Atlantic states, 88.1; eastern ates, 86.5; western Gulf states, 88.8; lower lake region,

89.6; upper lake region, 89.5; Ohio valley and Tennessee, 87.9; upper Mississippi valley, 85.6; Missouri valley, 84.4; north Pacific coast region, 85.9; middle Pacific coast region, 85.7; south Pacific coast region, 96.1.

There were one hundred omissions to predict (twenty-three being due to the absence of reports from the Pacific coast,) out of 3,813, or 2.62 per cent. Of the 3,713 predictions that have been made, one hundred and fourteen, or 3.07 per cent., are considered to have entirely failed; one hundred and eighteen, or 3.18 per cent., were one-fourth verified; three hundred and twenty-nine, or 8.86 per cent., were one-half verified; three hundred and seventy-six, or 10.13 per cent., were three-fourths verified; 2,776, or 74.76 per cent., were verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During December, 1882, one hundred and fifteen cautionary signals were displayed; of these, one hundred and one, or 87.83 per cent., were justified by winds of twenty-five miles per hour at or within one hundred miles of the station. Seventy-one cautionary off-shore signals were displayed; of these, sixty-six, or 92.96 per cent., were fully justified, both as to direction and velocity; three cautionary off-shore signals were justified as to velocity, but not as to direction. Four cautionary Northwest signals were ordered, all of which were justified as to direction, and one was justified as to direction and velocity. One hundred and ninety signals of all kinds were displayed, of which one hundred and sixty-eight, or 88.42 per cent., were fully justified. These do not include signals ordered at sixty-nine display stations, where the velocity is only estimated. Five signals were ordered late.

One hundred and sixty-six winds of twenty-five miles or more per hour were reported for which no signals were ordered; most of these were high local winds or strong sea-breezes.

NAVIGATION.

STAGE OF WATER IN RIVERS.

The highest and lowest stages of water observed at the Signal Service stations, during the month of December, 1882, are given in the table on the right-hand of chart iii. In the first column of this table are given the heights of water which have been found dangerous to property at the stations.

The Mississippi river was frozen as far south as Dubuque, Iowa, on the 8th, and remained closed during the remainder of the month. At Keokuk, Iowa, the river reached its highest point on the 31st, when it was within two feet and two inches of the danger-line. The lower Mississippi remained nearly stationary during the month, reaching its highest stage at Vicksburg, Mississippi on the 1st; at New Orleans, Louisiana, on the 5th, 6th, and 22d, and at Port Eads, Louisiana, on the 20th. At Saint Louis, Missouri, on the 18th, the river reached its lowest stage since November 29th, 1880, interrupting navigation, but rose on the 20th and 21st, when navigation was resumed. The Missouri river was highest at Leavenworth, Kansas, on the 19th; at Omaha, Nebraska, it was frozen from the 7th to the close of the month; and was frozen from the 2d to the close of the month at Yankton, Dakota. The Ohio river was highest at Cincinnati, Ohio, on the 29th, and at Louisville, Kentucky, on the 23d and 29th. At Pittsburgh, Pennsylvania, on the 11th, a special river report from New Geneva, Pennsylvania, was bulletined along the river front, stating a rise of five feet in the Monongahela river at that place. All vessels were loaded and prepared to depart as soon as the rise reached this point, and on the morning of the 12th, the river rose rapidly, permitting all of the boats to leave. The Cumberland river at Nashville, Tennessee, reached a height on the 3d and 4th sufficient to admit boats of heavy draught, and the winter steamboat season began on those dates. At Shreveport, Louisiana, on the 4th, work was suspended on the bridge across the Red River at that place on account of high water. On the 18th, the river fell rapidly, and on the 24th, work on the bridge was resumed. The Tennessee river at Chattanooga reached its lowest stage on the 9th and 10th, being unusually low for the season.

FLOODS.

Umatilla, Oregon, 14th.—Very heavy floods have occurred in the surrounding country. The town of Pendleton, Oregon, was flooded, and several buildings were carried away. Persons were compelled to climb trees to escape drowning. Several buildings on the Umatilla river were carried away, and wash-outs occurred along portions of the railroad, causing delay of trains. The damage done at Pendleton is estimated at $250,000. On the 15th, the Willamette river rose three and one-half feet during twenty-four hours, reaching a higher point than ever known at this place.

Dayton, Washington Territory, 13th.—Touchet creek, which flows through this place, reached a higher point than it has touched for many years. No damage resulted in this vicinity other than the carrying away of fences and small bridges. Trains on the Oregon Railway and Navigation Company's railroad were discontinued owing to landslides, overflowed track, and damaged bridges. Nearly five inches of rain fell during the day, which is the heaviest rainfall of which there is any record at this place. The water in Touchet creek began falling at 5 a. m. of the 14th.

Lewiston, Idaho.—Very heavy rains fell during the 14th and 15th, the amount of rainfall being the largest ever known at this place. The Snake river rose about six feet and the Clearwater river rose four feet. Large quantities of drift were carried down the Snake river, making navigation dangerous. No damage resulted at this place.

Portland, Oregon.—Very heavy rain storm during the 12th and 13th. During the twenty-four hours ending at 8 p. m. of the 13th, 6.68 inches of rain fell. The storm ended during the night of the 13th. The river rose to seventeen feet and one inch above low-water mark, being a rise of ten feet and seven inches in forty-eight hours. Trains were delayed on the railroads on account of washing away of bridges, etc. The damage at this place was slight; a few small bridges were washed away and cellars filled with water. The rainfall during the storm was 12.83 inches.

HIGH TIDES.

Hatteras, North Carolina, 30th.

LOW TIDES.

New Haven, Connecticut, 8th.—The high westerly winds have caused remarkably low tides. Over the flats, where at high tide there is usually four feet of water, the ground is bare. Vessels are much inconvenienced by the low water.

ICE IN RIVERS AND HARBORS.

Mississippi river.—Saint Paul, Minnesota: floating ice in river on the 2d and 1th; river frozen from 7th to close of month. La Crosse, Wisconsin, floating ice, 2d, 3d; ferry boat "Warsaw" made last trip of season on 6th; river entirely frozen over on 8th.

Dubuque, Iowa.—Floating ice, 1st, 4th, 5th; ferry-boat forced down river a mile to effect landing on 6th; ferry-boat stopped running, and ice-dam above the railroad bridge on the 7th; river frozen over on 8th; teams crossing on ice, 11th; river rising, lifting ice and preventing teams from crossing on 21st; teams again crossing ice on 28th.

Davenport, Iowa.—Floating ice from 1st to 9th; ferry-boats stopped running, 6th; river closed at Le Claire, Iowa, on 7th; river frozen over, 10th; persons crossings on ice, 13th; teams crossing on ice, 15th; ice moving on rapids above the city, 21st. At 4.00 a. m. of the 22d, the ice in the river broke up below the bridge, crushing the platform of the Saint Louis and Saint Paul Packet Company's warehouse. The ferry-dock was broken from its moorings and carried one hundred yards down the river. The boat house belonging to the Davenport boat club was also damaged. Floating ice from 23d to 29th; teams crossing ice on the 30th and 31st.

Clinton, Iowa.—Floating ice, 3d; river frozen over, 7th.

Muscatine, Iowa.—River frozen over at Fairport, eight miles above this place on 7th; river frozen over at Muscatine, 24th.

Burlington, Iowa.—Floating ice, 3d; ferry-boats put into winter quarters, 6th; river frozen over, 15th.

Keokuk, Iowa.—The steamer "Minneapolis" (last boat of season) departed on the 4th; floating ice, 6th to 13th; ice-dam five miles below station, causing rapid rise on the 14th; river gorged at this place during morning of 15th; ice breaking up in river, 22d; ice-dam broke but formed again lower down the river on 23d.

Saint Louis, Missouri.—Ice forming rapidly in river on the 7th; floating ice from 10th to 13th, 15th to 18th, 24th, 29th, 31st; on the 18th, the river reached its lowest stage since November 29th, 1880; river rising, 20th; navigation resumed, 21st.

Cairo, Illinois.—Floating ice on the 8th and 9th, closing navigation northward on the latter date; river free of ice, 20th.

Point Pleasant, Louisiana.—Floating ice in river on the 11th.

Ohio river.—Portsmouth, Ohio: navigation suspended on account of floating ice from 16th to 20th; navigation resumed, 21st. Cincinnati, Ohio, floating ice, 8th, 16th to 20th.

Vevay, Indiana: river full of floating ice on 16th; ferry-boats crossing with great difficulty, and navigation generally suspended on the 18th.

Louisville, Kentucky: light ice running from 17th to 21st.

Missouri river.—Fort Bennett, Dakota: river frozen over on the 7th. Yankton, Dakota, river closed from the 2d, to the close of the month.

Omaha, Nebraska: river frozen over on the 7th.

Leavenworth, Kansas: slush ice running, 2d, 3d, 4th, 7th; river frozen along the shores compelling ferry-boats to stop running on the 7th; floating ice, 9th; river clear of ice, 12th; floating ice, 15th; ice-dam, 16th, 17th, 18th; ice-dam broke and navigation resumed during morning of the 19th; floating ice from 23d to 31st.

Hudson river.—Albany, New York: floating ice, 2d, 3d; the steamer "St. John," (last boat of season) departed, 3d; river frozen, navigation closed, 4th; navigation on canals officially closed, 7th. New York City, the steamer "Cayuga," left this port on the 7th, bound northward, but was compelled to return on account of ice. Reports from Poughkeepsie state that navigation is closed at all points north of that place. The steamers of the New York and Rondout Line, have stopped running; and for the first time in seven years, no boats are frozen in the ice. Ardenia, New York, river clear of ice and navigation unobstructed on the 12th.

Lake Michigan.—Chicago, Illinois: navigation closed, 7th; lake frozen, 8th.

Lake Huron.—Port Huron: Saint Clair river frozen over on 8th; navigation closed between this port and Detroit, but still open to Algonac on the 10th; the schooner "Tecumseh," (last boat of season) arrived from Georgian bay on 12th; Lake Saint Clair frozen over, 16th; floating ice in Saint Clair river, 17th, 18th.

Lake Superior.—Marquette, Michigan: harbor frozen over on the 8th; ice moved from around the docks on the 19th.

Lake Ontario.—Rochester, New York: the last schooner ("Great Western") cleared from the port of Charlotte, New York, on the 6th, bound to Port Hope, Ontario, and the last arrival (schooner "Rutherford") from Port Hope, on same date.

Mackinac Straits.—Mackinac City: slush ice along the shores of the straits on the 14th; straits frozen over with ice from one-half to two and one-half inches thick on 18th.

Lake Erie.—Cleveland, Ohio: lake filled with slush ice, 15th; frozen for a distance of one-fourth of a mile from the shore, 16th; ice ten inches thick, 18th; ice broke in lake, 24th.

Presque Isle Bay.—Erie, Pennsylvania: ice from ten to twelve inches thick in bay, 19th.

Buffalo river.—Buffalo, New York: river frozen over at this place on 8th; river frozen at mouth, 15th.

Maquoketa river.—Monticello, Iowa: river closed on the 6th, having been open two hundred and seventy-three days, being twenty-three days less than for 1881.

Rock river.—Rockford, Illinois: floating ice in river, 1st; river frozen over, 3d.

Embarrass river.—Charleston, Illinois: ice four inches thick on 11th; six inches thick, 18th; ice broke and river rose eight feet, 22d.

Eel river.—Logansport, Indiana: during the morning of the 22d, the ice in the river broke up, being from eight to nine inches in thickness, and passed out without causing damage.

Little Bay De Noquet.—Escanaba, Michigan: last boat of season departed on 7th; bay frozen over, 10th; ice broke up during the morning of the 12; bay frozen over, 16th.

Thunder Bay and Thunder Bay river.—Alpena, Michigan: floating ice in river, 3d; river frozen over and bay partly frozen on the 8th; bay entirely frozen over, and navigation closed for season on the 10th.

Grand river.—Grand Haven, Michigan: Grand river frozen over 6th; river partly open, 12th; river closed, 16th; river open and free of ice, 21st.

Cuyahoga river.—Cleveland, Ohio: river frozen, but opened by tugs on the 7th; several vessels frozen in ice on western part of the lake on the 8th; navigation closed, 14th; ice broke in river, 24th.

Maumee river.—Toledo, Ohio: river covered with thin ice on the 3d; much ice in bay and floating in river, 4th; river frozen over and navigation closed, 7th; ice six inches thick in river on 9th.

Sandusky bay.—Sandusky, Ohio: ice in bay from one to one and a half inches thick, but was broken up by wind on 3d; the steamer "Jay Cook," and sailing vessel "Hattie Wells" (last boats of season), left this port on 6th. Bay froze over during night of 7th.

Detroit river.—Detroit, Michigan: a solid barrier of ice formed across the river near Amherstburg, Michigan, on the 9th, closing navigation; the schooner "Unadilla" was caught in the ice on Lake Erie and several other vessels were cut down by ice; the steamer "City of Detroit" could not return from Cleveland.

Connecticut river.—New Haven, Connecticut: navigation closed on 4th. New London, Connecticut, ice on ponds in vicinity, from six to thirteen inches in thickness, on 31st.

Penobscot river.—Bangor, Maine: river frozen over on 4th; river open, 6th; navigation closed, 8th.

Susquehanna river.—Catawissa, Pennsylvania: the north branch of the Susquehanna was closed by ice on the 8th, but opened gradually during the latter part of the month.

Lake Champlain.—Plattsburg, New York: very heavy ice in harbor and great difficulty experienced in making landings on the 20th.

Alleghany and Monongahela rivers.—Pittsburgh, Pennsylvania: during the early morning of the 24th, the ice broke in the Alleghany, a few miles above the junction, and came down with such force as to do great damage to property along the river banks. The Monongahela river was full of ice, and rose two feet from 1.00 to 3.00 p. m. No damage was done to steamboat property at this city, but the damage to lumber yards is estimated at $16,000. Morgantown, West Virginia, floating ice in the Monongahela on the 8th, 9th, 18th, 19th, 20th.

Des Moines river.—Des Moines, Iowa: river frozen over on 6th.

Yellowstone river.—Terry's Landing, Montana: river frozen over on 28th.

Erie canal.—Rochester, New York: ice three inches thick, and five boats ice-bound between Syracuse and Rochester, on the 8th.

Delaware and Raritan canal.—Bordentown, New Jersey: canal closed by ice from 18th to 27th, inclusive.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, at the Signal Service stations, and the average depth at which the observations were taken, are given in the table on the right-hand of chart ii. In the first column of the table, is given the maximum temperature observed during the month; and in the second column, the minimum temperature observed during the same period. Owing to ice formation, observations

were interrupted at the following stations: Escanaba, Michigan, on the 10h, 11th, 16th to 31st; Alpena, Michigan, from the 8th to 31st; Milwaukee, from 1st to 18th; Toledo, Ohio, from 7th to 31st; Detroit, Michigan, from 8th to 31st; Chicago, Illinois, from 8th to 31st; Cleveland, Ohio, from 16th to 20th; Buffalo, New York, from 15th to 31st. Sandusky, Ohio, from 7th to 31st. At Marquette, Michigan, no observations were made from 4th to 18th, owing to breakage of instruments. At Cleveland, Ohio, rough sea prevented observations from being made on 2d and 7th.

The table below shows the highest and lowest temperatures of water at the several stations; the range of water temperature; the mean temperature of the air at the station; and the depth of water at which the observations were taken:

Temperature of Water for December, 1882.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.		Mean temperature of the air at station.
	Max.	Min.		ft.	in.	
	°	°	°			°
Atlantic City, New Jersey	45.5	34.5	11.0	5	10	33.7
*Alpena, Michigan	34.5	28.7	5.8	7	6	24.2
Augusta, Georgia	48.0	42.0	6.0	8	8	45.0
Baltimore, Maryland	44.0	33.0	11.0	9	3	36.7
Block Island, Rhode Island	45.5	34.8	10.7	8	4	34.5
Boston, Massachusetts	36.0	33.2	2.8	25	0	30.5
*Buffalo, New York	39.0	32.0	7.0	8	10	27.8
Cedar Keys, Florida	65.0	46.0	19.0	8	8	54.9
Charleston, South Carolina	51.6	47.1	4.5	40	1	48.3
*Chicago, Illinois	34.8	32.4	2.4	7	7	26.0
Chincoteague, Virginia	43.0	31.0	2.0	5	11	36.4
Cleveland, Ohio	39.7	32.4	7.3	14	0	27.3
*Detroit, Michigan	35.0	33.0	2.0	23	10	31.0
*Delaware Breakwater, Delaware	44.3	36.6	7.7	5	6	35.7
Duluth, Minnesota	37.0	32.6	4.4	15	9	17.0
Eastport, Maine	44.3	38.7	5.6	17	5	24.5
*Escanaba, Michigan	38.8	33.0	5.8	15	0	22.9
Galveston, Texas	59.0	52.0	7.0	14	9	57.3
*Grand Haven, Michigan	34.5	28.0	6.5	19	0	28.2
Indianola, Texas	63.6	50.5	13.1	8	10	57.2
Jacksonville, Florida	57.0	53.0	4.0	18	0	54.2
Key West, Florida	77.8	67.6	10.2	15	7	69.5
Mackinac City, Michigan	40.6	32.0	8.6	13	0	26.5
*Marquette, Michigan	35.9	34.0	1.9	10	6	24.1
*Milwaukee, Wisconsin	34.6	31.6	3.0	8	0	24.3
Mobile, Alabama	64.0	47.0	17.0	15	8	48.5
New Haven, Connecticut	39.1	30.8	8.3	14	6	29.0
New London, Connecticut	43.0	39.0	4.0	12	0	31.3
Newport, Rhode Island	43.7	34.7	9.0	10	8	32.6
New York City	40.2	34.4	5.8	17	0	32.2
Norfolk, Virginia	45.0	37.0	8.0	18	2	40.5
Pensacola, Florida	59.8	49.7	10.1	17	3	50.5
Portland, Maine	40.0	32.0	8.0	18	2	28.7
Portland, Oregon	46.4	38.9	7.5	60	3	45.8
Port Eads, Louisiana	56.9	46.0	10.9	9	3	57.4
Provincetown, Massachusetts	44.5	35.0	9.5	14	0	32.8
Punta Rassa, Florida	71.6	59.6	12.0	10	9	62.6
*Sandusky, Ohio	33.0	32.0	1.0	10	0	29.2
Sandy Hook, New Jersey	47.6	34.3	13.3	1	5	33.3
San Francisco, California	52.4	50.0	2.4	31	10	51.9
Savannah, Georgia	48.6	43.7	4.9	12	5	50.8
Smithville, North Carolina	51.6	45.0	6.0	10	0	44.5
*Toledo, Ohio	33.9	32.9	1.0	19	2	30.1
Wilmington, North Carolina	48.0	37.5	10.5	13	0	46.0

*Observations wanting, see text.

The largest monthly ranges of water temperature are: Cedar Keys, Florida, 19°; Mobile, Alabama, 17°; Sandy Hook, New Jersey, 13°.3; Indianola, Texas, 13°.1; Punta Rassa, Florida, 12°. The smallest are: Chincoteague, Virginia, 2°; San Francisco, California, 2°.4; Jacksonville, Florida, 4°; New London, Connecticut, 4°; Duluth, Minnesota, 4°.4; Charleston, South Carolina, 4°.5; Savannah, Georgia, 4°.9

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most extensively observed display of the month occurred on the evening of the 15th. It was observed generally throughout New England; as far southward as northern New Jersey, and westward to stations in Iowa, Minnesota and Montana. The following description of this display are given:

Eastport, Maine, 15th.—Brilliant auroral arch was visible from 7.00 p. m. until the early morning of the 16th.

Portland, Maine, 15th.—An aurora was visible from 8.00 to 11.30 p. m.; it consisted of a segment of haze surmounted by an arch of greenish-white light extending to an altitude of 20°.

Gardiner, Maine, 15th.—Aurora first observed at 8.00 p. m.; at 9.00 p.m., a low double arch appeared, with dark segment beneath the lower arch; faint beams were visible. The display continued throughout the night.

Boston, Massachusetts, 15th.—An aurora was observed at 10.00 p. m.; it consisted of a well-defined arch of about 8° in width, with its centre about 20° above the horizon.

New Haven, Connecticut, 15th.—From 8.30 p. m. to midnight an auroral light of moderate brilliancy was observed in the north.

Point Judith, Rhode Island, 15th.—From 7.40 p. m. to daylight of the 16th, a bright yellow auroral light was observed; it extended from northwest to northeast and to an altitude of 15°.

Escanaba, Michigan, 15.—At 9.30 p. m., an aurora, consisting of a pale green light, with dark base, was observed. After midnight an arch was formed and waves of green light were visible. The display continued until 6.30 a. m. of the 16th.

Duluth, Minnesota, 15th.—At 6.45 p. m. a brilliant aurora was observed. It consisted of a dark arch of about 20° altitude from which pale straw and rose-colored streamers shot upward. The display ended at 9.35 p. m.

Springfield, Illinois, 16th.—An aurora was first observed at 4.40 a. m. of the 16th. Streamers extended from near the horizon to an altitude of 35°, and covered about 30° of the northern horizon. These display ended at 5.30 a. m.

Fort Assinniboine, Montana, 16th.—Auroral light observed from 4.00 a. m. to daylight.

Cresco, Iowa, 15th.—From 7.45 to 10 00 p. m., an aurora was visible in the north-northeast; it consisted of a low arch near the horizon.

Monticello, Iowa, 15th.—A very bright aurora was seen; it lasted all night.

This display was also observed at the following stations: Orono, Maine; Charlotte, Vermont; Grafton, New Hampshire; Cambridge, Fall River, and Somerset, Masschusetts; Narragansett Pier and Newport, Rhode Island; Factoryville, New York; Paterson, New Jersey; Northfield, Minnesota; Manitowoc, Wisconsin; Clinton, Cedar Rapids and Humboldt, Iowa.

Others displays were observed on the following dates:

Bismarck, Dakota, 2d.—At 6.00 a. m., a short nebulus auroral beam of 10° in length appeared on the northwestern horizon.

Rising Sun, Indiana, 2d.—Aurora at 7.00 p. m.

Northfield, Minnesota, 2d.

Ithaca, New York, 3d.—Aurora consisting of an arch of white light.

Bangor, Maine, 4th.—An aurora was observed at 4.00 a. m., extending a short distance above the horizon.

Saint Vincent, Minnesota, 6th.—Faint auroral light from 7.00 to 9.00 p. m. Northfield, Minnesota, 10th.

Springfield, Masschusetts, 11th.—Pale yellow auroral light in northern sky.

Fort Brady, Michigan, 11th.—Aurora at 9 p. m.

Tobacco Garden, Dakota, 11th.—Faint aurora at 9.00 p. m.

Fort Macon, North Carolina, 12th.—Faint aurora from 7.30 to 8.50 p. m., consisting of a uniform whitish glow extending in the form of an arch to an altitude of 12°.

Woodstock, Maryland, 14th.—An auroral arch with dark cloud beneath observed.

Fort Myer, Virginia, 16th.—Aurora in northeastern sky; it began during the night and continued till daylight.

Wellsborough, Pennsylvania, 16th.

Fort Keogh, Montana, 16th.—Aurora lasting until 5.50 a. m. of the 17th. Small beams of yellowish color shot upward toward the zenith.

Bangor, Maine, 18th, 19th, 20th.

Springfield, Massachusetts, 17th.—Pale auroral streamers reaching beyond the zenith. An arch was formed with its centre about 20° from the zenith.

Northfield, Minnesota, 17th.

Eastport, Maine, 18th.—Aurora from 11.00 p. m. to morning of the 19th, consisting of an arch of about 30° in altitude.

Springfield, Massachusetts, 19th.—Extensive pale auroral light in the north, with a few streamers.

Fort Myer, Virginia, 19th.—Aurora during night, lasting until daylight.

Mount Washington, New Hampshire, 20th.—Aurora from 7.10 to 9.35 p. m.

New Market, New Hampshire, 20th.—Brilliant aurora with beams of various colors.

Grafton, New Hampshire, 20th.—Aurora observed at 9.15 p. m.

Newport, Vermont, 20th.

Eastport, Maine, 20th.—Brilliant auroral arch from 8.00 p. m. to morning of 21st.

Gardiner, Maine, 20th.—At 7.20 p. m., low auroral arch with beams; at 9.00 p. m., arch disappeared; at 10.00 p. m., very brilliant beams of greenish light. The display continued throughout the night, and at 5.30 a. m. of 21st, a brilliant irregular arch appeared above a dark cloud.

Orono, Maine, 20th.

North Benton, Montana, 20th.—Aurora from 6.00 to 7.30 p. m.

Bismarck, Dakota, 21st.—Auroral light in the northern sky from 5.30 a. m. till daybreak.

Cedar Rapids, Iowa, 23d.

Fort Stevenson, Dakota, 27th.—Aurora in north from 9.30 until after 10.00 p. m.

Fort Brady, Michigan, 27th.—Aurora at 8.00 p. m.; obscured by fog at 9.00 p. m.

Buffalo, New York, 31st.—From 10.25 to 11.20 p. m., a faint orange-colored auroral light resembling the morning dawn.

ATMOSPHERIC ELECTRICITY INTERFERING WITH TELEGRAPHIC COMMUNICATION.

Fort Maginnis, Montana, 5th.—Atmospheric electricity rendered working of telegraph lines impracticable. The current was so strong that the office-wires were melted and the operator was severely stunned by contact with the instruments. A violent snow-storm prevailed at the time, during which all metal points in the vicinity of the wires, such as nails, screws, etc., were tipped with light.

THUNDER-STORMS.

Thunder-storms were reported in the various states, on the following dates:

Alabama.—Auburn, 22d; Mobile, 10th, 19th, 21st; Mount Vernon Barracks, 21st.

Arkansas.—Fort Smith, 19th.

Florida.—Cedar Keys, 22d; Fort Brooke, 10th, 15th, 22d; Jacksonville, 22; Pensacola, 10th, 21st, 22d.

Georgia.—Augusta, 21st; Savannah, 21st.

Illinois.—Cairo, 5th; Springfield, 4th.

Kansas.—Creswell, 19th; Independence, 19th, 20th; Leavenworth, 6th; Yates Centre, 19th.

Louisiana.—New Orleans, 5th, 10th, 15th, 21st; Point Pleasant, 19th; Port Eads, 15th, 21st.

Maine.—Bangor, 31st.

Massachusetts.—Mendon, 31st; Fall River, 31st.

Missouri.—Pierce City, 19th, 20th; Protem, 19th.

North Carolina.—Cape Lookout, 21st; Fort Macon, 13th; Hatteras, 13; Portsmouth, 13th, 21st.

South Carolina.—Stateburg, 21st.

Tennessee.—Nashville, 20th.

Texas.—Coleman City, 21st; Denison, 19th; Fort McKavett, 19th; Galveston, 18th, 19th; Indianola, 20th, 24th; Palestine, 19th.

Washington Territory.—Fort Canby, 17th.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts, on the following dates:

New England.—3d, 4th, 5th, 7th, 9th, 10th, 13th, 20th, 26th, 27th.

Middle Atlantic states.—4th, 6th, 14th, 17th, 18th, 20th.

South Atlantic states.—7th, 10th, 14th, 19th, 20th, 23d, 29th.

Florida peninsula.—7th, 16th, 21st, 24th, 26th.

Western Gulf states.—2d, 6th, 14th, 16th, 24th.

Ohio valley and Tennessee.—1st to 4th, 7th, 12th, 14th, 15th, 17th to 20th, 24th, 25th.

Extreme northwest.—2d, 5th, 6th, 12th, 20th.

Upper Mississippi valley.—1st, 2d, 3d, 7th, 10th, 12th to 16th, 18th, 24th, 25th, 31st.

Northern plateau.—1st, 18th, 19th, 20th, 22d.

Solar halos were also reported from the following stations, not included in the districts named above:

San Francisco, California, 2d, 10th, 16th, 20th, 23d, 26th, 27th, 29th, 30th; Oakwood, California, 27th; Poway, California, 28th; San Diego, California, 28th; Visalia, California, 1st, 3d, 17th; Fort Custer, Montana, 10th; Ruggles, Ohio, 7th; Lansing, Michigan, 8th; Riley, Illinois, 24th, 31st; Protem, Missouri, 4th, 12th, 13th, 24th, 30th; Topeka, Kansas, 11th; Creswell, Kansas, 8th, 30th; Fort Maginnis, Montana, 13th; Yates Centre, Kansas, 1st, 3d, 4th, 30th; Pretty Prairie, Kansas, 5th; Salt Lake City, Utah, 2d, 3d, 16th; Eagle Rock, Idaho, 20th; Fayette, Mississippi, 28th, 29th, 30th.

LUNAR HALOS.

Lunar halos have been observed in the various districts, on the following dates:

New England.—15th, 17th, 20th, 21st, 22d, 25th, 26th, 29th.

Middle Atlantic states.—2d, 8th, 15th, 17th to 20th, 22d, 23d, 25th, 26th, 27th.

South Atlantic states.—17th, 19th to 28th.

Florida peninsula.—24th, 25th.

Eastern Gulf states.—15th, 18th, 24th, 27th.

Western Gulf states.—17th, 18th, 22d, 23d, 24th, 26th, 27th, 31st.

Ohio valley and Tennessee.—14th, 16th, 17th, 19th, 21st, 24th. 25th.

Lower lake region.—4th, 19th, 20th, 25th.

Upper lake region.—5th, 15th to 19th, 21st to 25th, 29th.

Extreme northwest.—2d, 19th to 23d, 25th.

Upper Mississippi valley.—1st, 5th, 7th, 14th, 15th, 18th, 24th, 31st.

Missouri valley.—16th, 19th to 25th.

Northern slope.—2d, 18th, 19th, 22d to 25th.

Middle slope.—2d, 4th, 16th, 18th to 21st, 23d, 30th.

Southern slope.—18th, 23d.

Southern plateau.—5th, 17th, 18th, 24th, 29th, 30th, 31st.

Middle plateau.—1st, 2d, 4th, 22d, 31st.

Northern plateau.—2d, 18th, 19th, 22d, 23d, 27th, 28th, 29th.

Lunar halos were also reported from the following stations, not included in the districts named above:

San Francisco, California, 2d, 15th, 16th, 17th, 20th, 21st, 23d, 25th, 26th; Los Angeles, California, 27th; Visalia, California, 16th, 22d; Roseburg, Oregon, 19th, 21st, 26th; Eagle Pass, Texas, 18th.

MIRAGE.

Creswell, Kansas, 7th.
Pretty Prairie, Kansas, 4th, 17th, 23d, 28th.
Genoa, Nebraska, 1st, 17th, 18th, 26th, 27th.
Indianola, Texas, 1st, 2d, 3d, 16th, 17th, 27th.

MISCELLANEOUS PHENOMENA.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the twenty-four hours succeeding each observation taken at sunset, have been observed at all Signal Service stations. Reports from one hundred and seventy-nine stations show 5,469 observations to have been made, of which twenty-seven were reported doubtful; of the remainder, 5,442, there were 4,626, or 85.0 per cent., followed by the expected weather.

SUN SPOTS.

The following records of sun spots for the months of November and December, 1882, have been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Massachusetts. The record for November was not received in time for publication in the REVIEW for that month:

DATE—Nov., 1882.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. of		REMARKS.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 8 a. m..	0	10	0	0	0	0	5	35†	One spot very large.
2, 12 m.....	0	0	0	0	0	0	5	35†	Do.
3, 8 a. m..	1	3	0	3	1	3	6	35†	Do.
5, 2 p. m..	0	0	1	10	0	0	5	25†	
6, 8 a. m..	0	5	2	10	0	5	3	20†	
6, 10 a. m..	0	0	0	0	0	0	3	20†	
8, 2 p. m..	2	15	1	5	1	5	4	30†	
9, 10 a. m..	0	0	1	5	0	0	3	25†	
10, 2 p. m..	1	1	0	0	0	0	4	25†	
12, 12 m.....	1	3	0	0	1	3	5	30†	
19, ———	.....	.....	.....	.....	.....	.....	4	25†	
22, 7 a. m..	.....	.....	.....	.....	.....	.....	6	40†	Three spots quite large.
23, 7 p. m..	0	0	0	5	0	0	6	35†	
24, 6 p. m..	0	0	1	5	0	0	4	30†	
26, 3 p. m..	0	0	1	5	0	0	3	25†	
27, 3 p. m..	1	10†	0	0	0	0	4	35†	
28, 4 p. m..	0	0	0	0	0	0	4	35†	
29, 4 p. m..	0	0	0	0	0	0	4	35†	

†Approximated. Faculæ were seen at the time of every observation. The record of November 19, 27, and 29 is taken from photographs of the sun, 4.5 inches in diameter, made with the horizontal photoheliograph of the Lick Observatory, Mount Hamilton, California.

DATE—Dec., 1882.	No. of new		Disappear'd by solar rotation.		Reappear'd by solar rotation.		Total No. visible.		REMARKS.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 5 p. m...	0	0	.....	.....	0	0	2	10‡	
2, 7 p. m...	0	0	0	0	0	0	2	10	
3, 6 p. m...	0	0	2	10	0	0	0	0	
4, 3 p. m...	1	5	0	0	0	0	1	5	
5, 4 p. m...	1	1	0	0	0	0	2	6	
6, 12 m....	1	2	0	0	0	0	3	8	
7, 6 p. m...	0	0	0	0	0	0	3	8	Spots mostly small.
8, 6 p. m...	0	0	0	0	0	0	3	8	Do.
9, 5 p. m...	0	4	0	0	0	0	3	15	Do.
12, 1 p. m...	1	10	.....	.....	1	10	3	20‡	
14, 7 p. m...	0	0	1	5	0	0	2	15‡	
15, 5 p. m...	0	0	0	0	0	0	1	10‡	
16, 3 p. m...	1	10	0	0	0	0	2	30‡	Many of the spots small.
20, 6 p. m...	0	0	.....	.....	0	0	2	15‡	Do.

‡Approximated. Faculæ were seen at the time of every observation. The record of spots for December 1, 2, 3, and 6 is taken from photographs of the sun, 4.5 inches in diameter, made with the horizontal photoheliograph of the Lick Observatory, Mount Hamilton, California.

The following record of observations has been forwarded by Mr. A. S. Bender, of Sacramento, California:

DATE—Dec., 1882.	No. of new.		Disa'pear'd by rotation.		Reappear'd by rotation.		Total No. of		REMARKS.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 10.30 a.m	.....	.....	2	20*	.....	.....	2	15*	Other groups disappeared, not by rotation, atmosphere thick, spots dim.
2, 11.30 a.m	.....	.....	.....	.....	.....	.....	2	15	Atmosphere thick, spots dim.
3, 11.15 a.m	.....	.....	.....	.....	.....	.....	.....	.....	Sun seems clear of spots but atmosphere thick, spots dim.
4, 11.30 a.m	.....	.....	.....	.....	.....	.....	.....	.....	Do.
5, 11.15 a.m	.....	.....	.....	.....	.....	.....	.....	.....	Do.
6, 12.15 a.m	.....	.....	.....	.....	.....	.....	.....	.....	Sun seems clear of spots but atmosphere thick, spots dim. After transit was over could see no spots but the atmosphere was very moist and probably spots existed both on this and former days.
10, 10.35 a.m	.....	.....	.....	.....	1	3	1	3	Atmosphere still very moist, one spot quite large.
12, 10.50 a.m	1	2	.....	.....	.....	.....	2	5	Atmosphere still very moist, possibly some spots invisible.
14, 3.00 p.m	.....	.....	.....	.....	.....	.....	2	15*	Atmosphere clearer, some spots very dim.
23, 10.00 a.m	.....	.....	.....	.....	.....	.....	2	8*	Some spots very dim.
25, 9.30 a.m	.....	.....	.....	.....	.....	.....	1	1	Not quite clear, there may be other spots.
26, 12.30 p.m	.....	.....	.....	.....	2	2	2	2	One spot disappeared, not by rotation, one quite large.
27, 1.10 p.m	.....	.....	.....	.....	.....	.....	2	2	
28, 11.40 a.m	.....	.....	.....	.....	.....	.....	2	2	
29, 11.00 a.m	.....	.....	.....	.....	.....	.....	2	2	
30, 12.10 p.m	1	8*	.....	.....	1	1	3	10*	One disappeared, not by rotation.

* Estimated.

Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: Sun spots were observed on all clear days during the month. They were least numerous on the 3d, most numerous on the 18th, and largest on the 30th.

METEORS.

Huron, Dakota, 5th.—A very brilliant meteor was observed at 10.35 p. m., passing downward from a point about 40° above southern horizon, and bursting, when at an altitude of 10°, into fine pieces resembling balls of fire. The meteor illuminated the surrounding country for several seconds, and left a trail which remained visible for ten seconds.

Yuma, Arizona, 10th, 11th, 13th, 16th, 19th, 20th, 31st.
Princeton, California, 3d.
Visalia, California, 2d, 20th, 28th.
Alexandria, Dakota, 31st.
Augusta, Georgia, 8th.
Vevay, Indiana, 11th, 13th, 24th.
Clinton, Iowa, 6th, 13th.
Davenport, Iowa, 1st, 2d.
Muscatine, Iowa, 4th.
Creswell, Kansas, 4th.
Fort Scott, Kansas, 2d, 9th, 17th.
Eastport, Maine, 31st.
Gardiner, Maine, 20th.
Portland, Maine, 20th.
Woodstock, Maryland, 6th.
Williamstown, Massachusetts, 12th.
Fall River, Massachusetts, 12th.
Alpena, Michigan, 7th.
Saint Vincent, Minnesota, 8th, 12th, 13th.
Freehold, New Jersey, 8th.
Kiantone, New York, 20th.
North Volney, New York, 11th.
Stateburg, South Carolina, 11th.
Knoxville, Tennessee, 5th.
Memphis, Tennessee, 11th.
Palestine, Texas, 2d, 10th.
Woodstock, Vermont, 20th.
Fort Myer, Virginia, 31st.

EARTHQUAKES.

Concord, New Hampshire, 19th.—One of the severest earthquake shocks ever experienced here, occurred at 5.24 p. m. There was a sound resembling that of a heavy explosion, causing buildings to shake, and frightening the inhabitants. The shock apparently travelled from east to west, as it was felt at Pittsfield, New Hampshire, about four minutes later than at this place. The shock was also felt at Great Falls, Manchester, and at other places in this state. The duration of the shock was about eight or ten seconds.

Dover, New Hampshire, 19th.—Two light, but very perceptible shocks of earthquake, lasting two seconds, were experienced here at about 5.15 p. m., today, causing great alarm. The shocks were accompanied by a rumbling noise, and are reported to have been felt at Rollinsford, Rochester, and other neighboring towns.

Contoocook, New Hampshire, 19th.—The heaviest earthquake shock experienced here during the last ten years, occurred at 5.20 p. m. of this date. The shock lasted several seconds.

New Market, New Hampshire, 19th.—An earthquake shock was felt here at 5.25 p. m. There was but one shock, lasting about ten seconds, and was the heaviest ever felt here. The vibration was from the north. A slight shock was also felt between midnight of the 24th and 1.00 a. m. of the 25th.

Visalia, California, 19th.—Two light shocks of earthquake were felt here at 11.45 p. m.; they were quite distinct, with an interval of about one minute between them. The vibration was from east to west.

Eastport, Maine, 31st.—A very perceptible shock of earthquake was felt at this city at 9.55 p. m. of this date.

Ashwood, Tennessee, 31st.—At about 7.00 p. m., a distinct shock of earthquake was felt here. The shock was of about three seconds duration, causing windows, etc., to rattle.

Bangor, Maine, 31st.—Slight shock of earthquake felt in this city at 9.30 p. m.

SAND-STORMS.

Yuma, Arizona, 18th.
Fort Garland, Colorado, 12th, 30th.
El Paso, Texas, 19th.

POLAR BANDS.

Riley, Illinois, 16th.
Gardiner, Maine, 21st.
Portland, Maine, 6th.
Protem, Missouri, 28th, 29th.
Clear Creek, Nebraska, 1st, 4th, 16th, 18th.
Freehold, New Jersey, 6th, 7th, 25th.
Vineland, New Jersey, 6th, 23d, 30th.
Nashville, Tennessee, 2d, 12th, 13th, 14th, 25th.
Fort Myer, Virginia, 6th, 19th.
Wytheville, Virginia, 2d, 5th, 6th, 8th, 9th, 14th, 19th, 25th, 27th.

ZODIACAL LIGHT.

Punta Rassa, Florida, 1st to 5th, 8th, 9th, 11th, 26th, 30th.
Cambridge Massachusetts.—Visible 3d, 4th, 8th, 12th, 28th, 29th, 30th; suspected 9th.
Somerset, Massachusetts, 2d, 12th, 28th, 29th, 30th.
Clear Creek, Nebraska, 26th, 27th, 28th.
Albany, Oregon, 30th, 31st.
Nashville, Tennessee, 5th to 8th, 10th to 13th, 30th.
Palestine, Texas, 1st, 3d, 10th, 11th, 13th, 14th, 16th, 20th, 29th.
Wytheville, Virginia, 31st.

PRAIRIE AND FOREST FIRES.

Fort Smith, Arkansas, 8th.
Yankton, Dakota, 4th.
Fort Supply, Indian Territory, 1st, 19th.
Fort Sill, Indian Territory, 1st, 2d, 12th.
Fort Concho, Texas, 8th, 11th, 20th.
Fort McKavett, Texas, 11th, 20th, 26th, 27th.
Creswell, Kansas, 2d, 3d, 9th, 11th, 12th.
Yates Centre, Kansas, 4th, 10th to 17th.
Poway, California, fire in mountains 16th.

DROUGHT.

Woodstock, Vermont, 31st.—Many wells are dry and in some places, farmers are compelled to melt snow for their stock.

Charlotte, Vermont.—The month closes with great scarcity of water in wells and springs; snow is melted for domestic purposes, and cattle are driven long distances for water.

MIGRATION OF BIRDS.

Geese flying southward.—Point Judith, Rhode Island, 11th; Narragansett Pier, Rhode Island, 11th, 14th; Augusta, Georgia, 30th; Hatteras, North Carolina, 26th; Denison, Texas, 12th; Coleman City, Texas, 14th; Lewiston, Idaho, 5th, 24th; Somerset, Massachusetts, 2d, 6th, 12th, 20th. *Flying southwestward.*—Block Island, Rhode Island, 12th, 14th. *Flying southeastward.*—Indianola, Texas, 17th.

Ducks flying northward.—Charleston, Illinois, 3d. *Flying westward.*—Creswell, Kansas, 20th. *Flying southward.*—Protem, Missouri, 1st; Coleman City, Texas, 22d, 27th.

NOTES AND EXTRACTS.

The following extract is taken from an article by Professor Dr. H. Wild, Director of the Physical-Central Observatory, at Saint Petersburg, Russia:

The cold of October, 1880, at Saint Petersburg: * * *. The mean temperature of October, 1880, at Saint Petersburg was only 31°.1 Fahr. (−0°.5 Cent.), while the October normal, as deduced from observations covering a period of 125 years, is 40°.1 Fahr. (4°.5 Cent.) Throughout the whole series of those years, there are only two Octobers in which the mean temperature was below 32°.0 Fahr. (0°. Cent.); viz.: In1757, mean 31°.5 (−0°.3), and 1811, mean 31°.6 (−0°.2). The month of October, 1880, was therefore the coldest experienced in 121 years. The daily mean for the 15th is even more remarkable than that for the entire month. On the 15th, the mean temperature for the day was below 32°.0 (0°.0); on the 18th and 19th, the temperature was a little above freezing, and from the 19th to the close of the month, it remained about 5° below zero (23°.0 Fahr).

In the 118 years for which we have complete observations for the individual days, there are only six years in which, as in October, 1880, a series of twelve consecutive days of hard frost are recorded. They are:

1757. From October 13th to 29th, when the mean remained below 32°.0 (0°.0).
1805. From October 17th to 31st, mean below 32°.0 (0°.0); (mean of the month 33°.3 Fahr., or 0°.7 Cent.).
1811. October 12th and 13th, and from the 17th to 31st; continual frost.
1827. From October 20th to 31st; mean below 32°.0 (0°.0).
1852. From October 18th to 31st; continual frost, monthly mean 34°.9 (1°.6).
1875. From October 18th to 29th; the temperature remained below freezing.

The last half of October, 1880, was not only very cold, but, during that period, much snow fell on twelve days.

* * * * *

On October 17th, the river Neva was covered with thick ice. The record relative to the opening and closing of the Neva, dates back to 1706; during this period of 174 years, the river has been covered with ice in October, only three times; viz.: October 29, 1805; October 31, 1811, and October 30, 1852.

Taking into consideration the twelve consecutive frost-days, the large amount of snowfall, and the closing of the Neva, we find that, at the most, only the years 1805 and 1811 can be compared with 1880, as regards an early winter.

While we cannot account for this abnormal condition during former years, owing to the incompleteness of the observations, we can, to some extent, do so for the year 1880. From the last synoptic charts of the Physical-Central Observatory, is seen, that, in the second half of October, many cyclonic disturbances passed Saint Petersburg. The centres of these disturbances, deviating from the normal course during this season, did not pass northwest, but southwest, of Saint Petersburg. Saint Petersburg was, therefore, not on the warm south side, but was on the cold north side, of these disturbances, which were laden with moisture from the ocean.

Why these storms pursued such an abnormal course, we cannot yet determine, any more than we could 100 years ago. The science of meteorology has been too much neglected to expect a speedy solution of such difficult problems.

The following is taken from the Annual Report of Dr. H. B. Baker, Secretary of the Michigan State Board of Health, 1878:

Meteorological conditions are known to have great influence on the health of the people; and certain groups of such conditions are known to be coincident with, and are believed to cause, directly or indirectly, a very great many deaths during each year; such, for instance, as a large proportion of the deaths from diseases of the bowels in summer; and of deaths from croup, bronchitis, inflamation of the lungs, etc., in winter. Any study of the causes of disease with a view to their prevention, must, therefore, include comparisons of their rates with statements of the meteorological conditions existing at the same time, or immediately preceding. Such comparisons can be made by years, by seasons, and by months, and will be facilitated by noting those years, seasons, or months, which are exceptional in any of the meteorological conditions observed, and ascertaining whether there were any exceptional facts concerning any disease which appear to correspond therewith; and if so, whether comparisons for a series of years, seasons, or months, show such correspondence to be constant. Conversely, exceptional times of disease supply peculiarly favorable opportunities for studying meteorological conditions which may influence the disease. In considering the question to what extent they are only incidental, all other conditions which can have influence in causing or modifying the disease must be kept in mind, or be separately considered. In order to eliminate the evidences of unknown or unconsidered influences, and of those which are only indirect or incidental, comparison must be made by different periods of time; as, for instance, if a given disease is found to prevail most in years when certain meteorological conditions prevail, it is needful to learn whether it also prevails most in months when the same meteorological conditions prevail; because the disease might be caused by something coincident with such conditions, and which only occur once in a year, and can, therefore, be coincident only by years. Conversely, it is useful to compare by years where a disease has been found coincident with certain meteorological conditions by months. Because of the interdependence of the several meteorological conditions it is usually the fact that when certain meteorological conditions are found to bear a more or less constant relation to a given disease, certain other meteorological conditions are found also to have nearly or quite as constant a relation, so that the cause of the disease is not certainly reached by means of this knowledge alone. Technical knowledge is requisite to appreciate the bearing of the evidence. There is much, however, that may be done in advancing this study by the meteorologist or physicist alone; because it not unfrequently happens that the usual harmony in the meteorological conditions is not maintained, some one or more being exceptionally prominent or absent as the case may be.

The following is taken from the Journal of the Franklin Institute, vol. cxiv., No. 682:

REVERSALS OF TEMPERATURE.

M. Alluard records several comparative observations in January and February, 1882, at the summit of Puy de Dome and at Clermont, which show that whenever an area of high-pressure covers central Europe, and especially France, it is attended by an inversion of temperature with increase of altitude. Arago observed such an inversion in 1839, and the phenomenon has

often been noticed subsequently. The visibility of Mont Blanc from the Puy de Dome furnishes a means of studying the distribution of densities in the lower layers of the atmosphere, especially at the epochs of the phenomenon in question. Faye proposes to institute observations upon geodesic refraction, between the summits of the Puy de Dome and certain points which are easily accessible upon Mont Blanc. The beautiful geodesic operations of the French War Department, under the direction of Col. Perier in connection with Spanish officers, show that it would be possible to institute reciprocal and simultaneous measurements of zenith distance between luminous signals upon the two mountains.—*Comptes Rendus*, xciv., 1175.

ERRATA.

The following corrections should be made in the REVIEW for November, 1882:

Page 4, International Meteorology, first paragraph, "Chart v. is prepared for November, 1880," should read, for December, 1880.

Page 5, "The accompanying table shows the deviations in pressure and temperature at isolated stations during August, 1880," should read, during September, 1880.

NOTE.

Co-operating observers who receive both the MONTHLY WEATHER REVIEW and the MONTHLY SUMMARY OF SIMULTANEOUS OBSERVATIONS will find chart iv., described in this REVIEW, in the SUMMARY for October, 1880.

No. I.

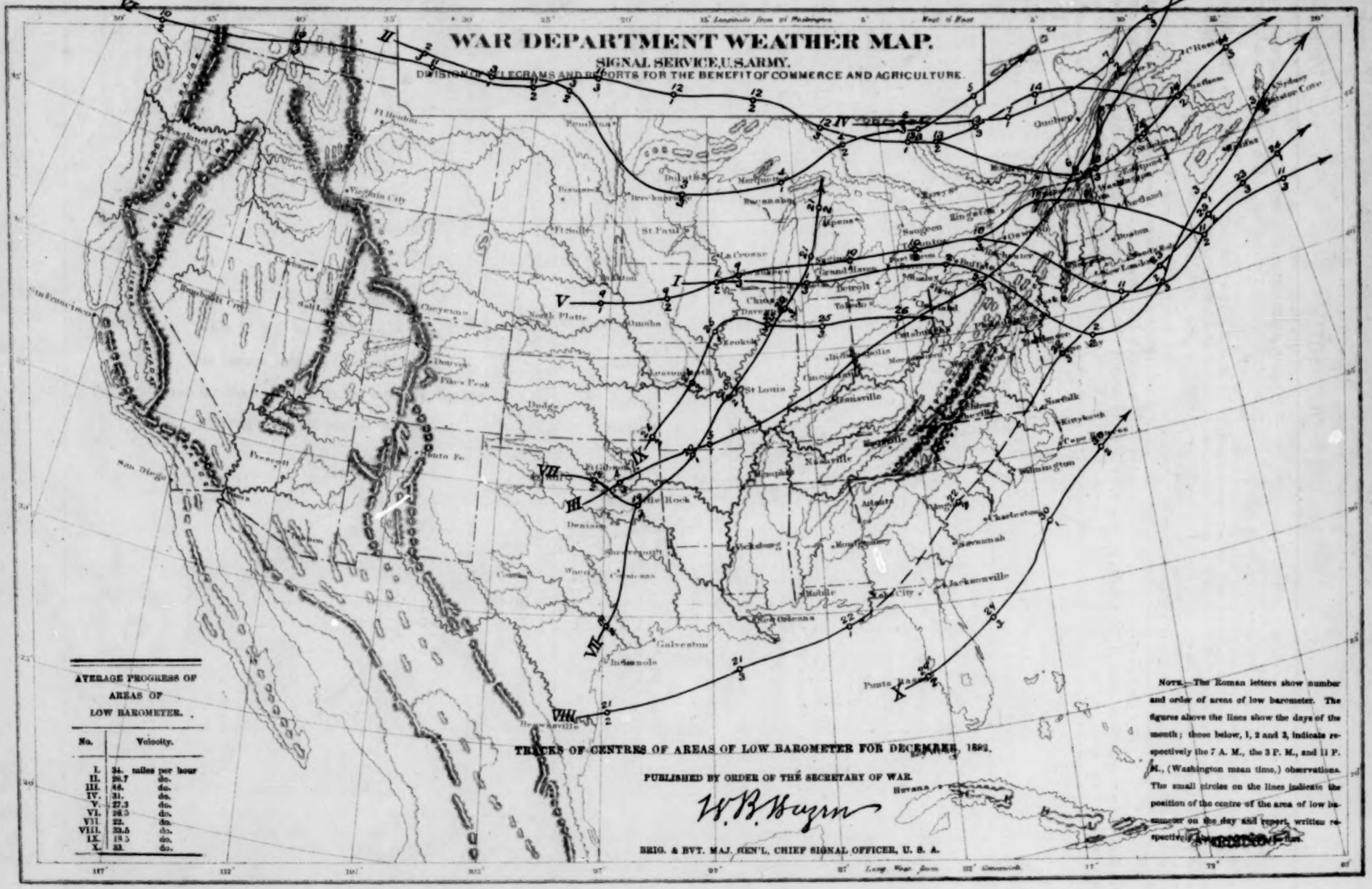
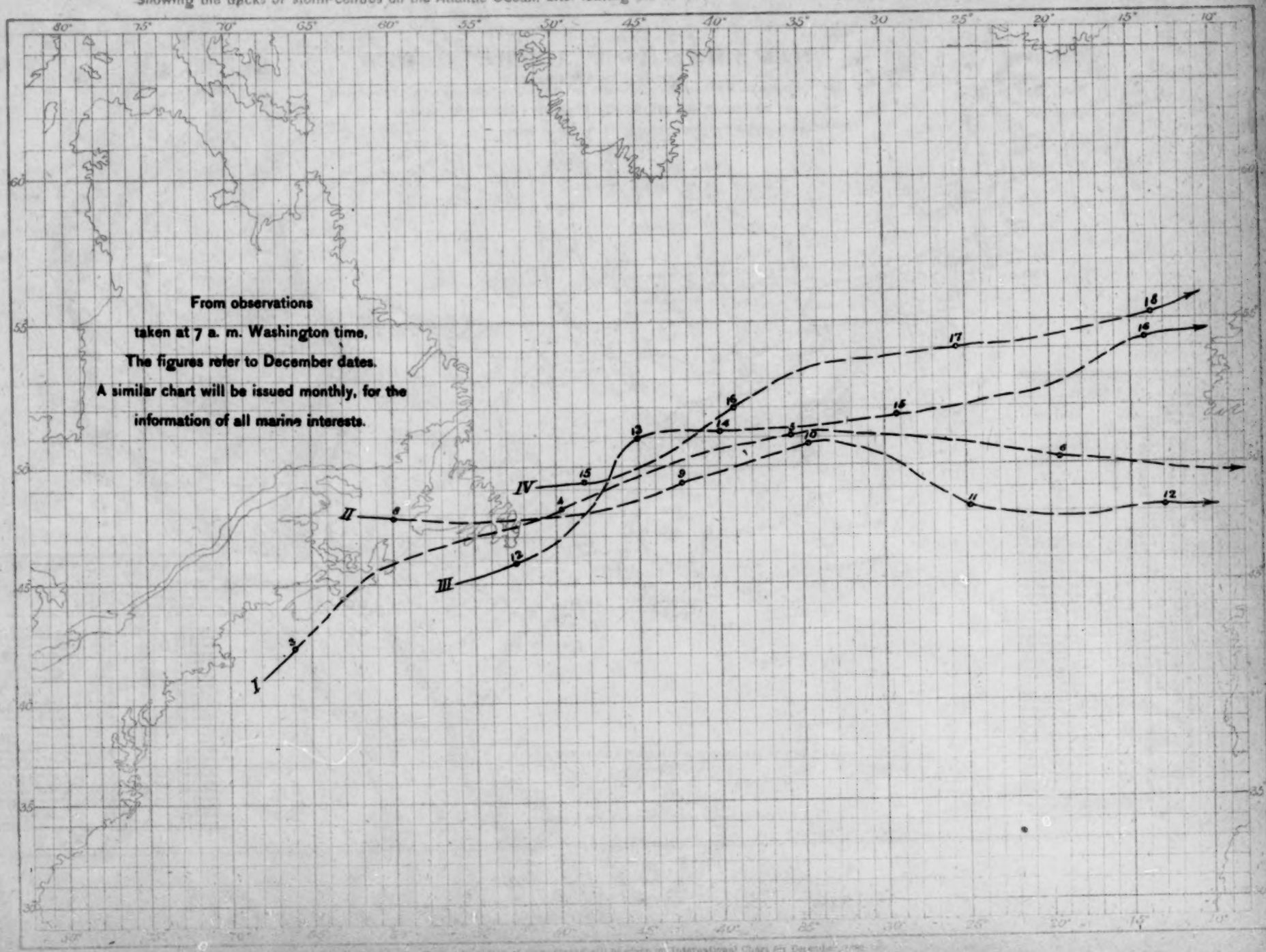

WAR DEPARTMENT WEATHER MAP.
SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER.
No. | Velocity.
I. 34. miles per hour
II. 28.7 do.
III. 48. do.
IV. 31. do.
V. 27.3 do.
VI. 26.5 do.
VII. 22. do.
VIII. 32.5 do.
IX. 18.5 do.
X. 33. do.
TRACKS OF CENTRES OF AREAS OF LOW BAROMETER FOR DECEMBER, 1882.
PUBLISHED BY ORDER OF THE SECRETARY OF WAR.
W. B. Hazen
BRIG. & BVT. MAJ. GEN'L, CHIEF SIGNAL OFFICER, U. S. A.
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above the lines.

CHART SUPPLEMENTAL TO NO. I.

Showing the tracks of storm-centres on the Atlantic Ocean, after leaving the coast of America, based upon data received up to January 20.



No. II.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

ISOBARS, ISOTHERMS AND PREVAILING WINDS FOR DECEMBER, 1882.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

W. B. Hazen

BRIG. & BVT. MAJ. GEN'L, CHIEF SIGNAL OFFICER, U. S. A.

AVERAGE TEMPERATURES FOR DECEMBER, 1882.

DISTRICTS.	Average for Dec., Signal Service observations. For several years.	For 1882.	Comparison of Dec., 1882, with the average for several years.
	°	°	
New England	30.9	29.9	1.0 below.
Middle Atlantic states	38.4	35.3	3.1 below.
South Atlantic states	48.4	45.4	3.0 below.
Florida peninsula	62.7	60.3	2.4 below.
Eastern Gulf states	48.6	48.0	0.6 below.
Western Gulf states	58.5	56.1	2.4 below.
Rio Grande valley	63.4	62.6	0.8 below.
Tennessee	42.0	38.9	3.1 below.
Ohio valley	35.7	34.0	1.7 below.
Lower lake region	29.0	27.7	1.3 below.
Upper lake region	24.1	22.0	2.1 below.
Extreme northwest	10.7	10.6	0.1 below.
Upper Miss. valley	25.7	24.1	1.6 below.
Missouri valley	23.3	22.6	0.5 above.
Northern slope	22.2	26.0	3.8 above.
Southern slope	44.9	42.9	2.0 below.
Northern plateau	29.3	32.5	3.2 above.
Middle plateau	31.3	35.6	4.4 above.
Southern plateau	43.9	45.1	1.2 above.
North Pacific coast	41.5	45.2	3.7 above.
Middle Pacific coast	46.4	49.2	0.8 above.
South Pacific coast	53.2	54.3	1.1 above.
Mt. Washington, N. H.	8.9	9.1	0.2 above.
Pike's Peak, Colo.	5.0	6.7	0.0 above.
Denver, Colo.	29.0	25.4	3.6 above.

TEMPERATURE OF WATER FOR DECEMBER, 1882.

STATIONS.	Temperatures at bottom. Max.	Min.	Average depth of water. Feet.	Inch.
	°	°		
Atlantic City, N. J.	45.5	34.5	5	10
*Alpena, Mich	34.5	28.7	7	6
Augusta, Ga	49	42	8	8
Baltimore, Md.	44	33	9	8
Block Island, R. I.	45.5	34.9	6	4
Boston, Mass.	36	23.2	25	0
*Buffalo, N. Y.	39	32	6	10
Burlington, Vt.				
Cedar Keys, Fla.	65	46	6	8
Charleston, S. C.	51.6	47.1	40	1
*Chicago, Ill.	34.8	22.4	7	7
Chincoteague, Va.	49	31	5	11
*Cleveland, Ohio	39.7	32.4	14	0
*Detroit, Mich.	35	33	23	10
Del. Breakwater, Del.	44.3	34.6	5	6
Duluth, Minn.	37	32.6	15	9
Eastport, Me.	44.3	38.7	17	6
*Escanaba, Mich.	33.6	23	15	0
Galveston, Texas	59	52	14	9
*Grand Haven, Mich.	34.5	28	10	0
Indianola, Texas	63.6	59.5	8	10
Jacksonville, Fla.	57	53	18	0
Key West, Fla.	77.6	67.6	15	7
Mackinaw City, Mich.	40.6	29	13	0
*Marquette, Mich.	30.9	24	10	6
*Milwaukee, Wis.	34.6	31.6	10	0
Mobile, Ala.	61	47	15	8
New Haven, Conn.	39.1	30.8	14	6
New London, Conn.	43	29	13	0
Newport, R. I.	43.7	34.7	10	8
New York City	40.2	34.4	17	0
Norfolk, Va.	45	37	16	9
Pensacola, Fla.	59.8	49.7	17	3
Portland, Me.	40	32	18	3
Portland, Oreg.	46.4	36.9	99	3
Port Eads, La.	56.9	46	9	8
Provincetown, Mass.	44.5	30	14	0
Punta Rassa, Fla.	71.6	60.6	10	9
*Sandusky, Ohio	33	32	10	0
Sandy Hook, N. J.	47.6	34.3	1	3
San Francisco, Cal.	52.4	50.0	31	10
Savannah, Ga.	48.6	47	12	8
Smithville, N. C.	51	[illegible]	10	0
*Toledo, Ohio	35.9	32.5	10	3
Wilmington, N. C.	54.4	37.5	13	0

* Observations wanting one week.

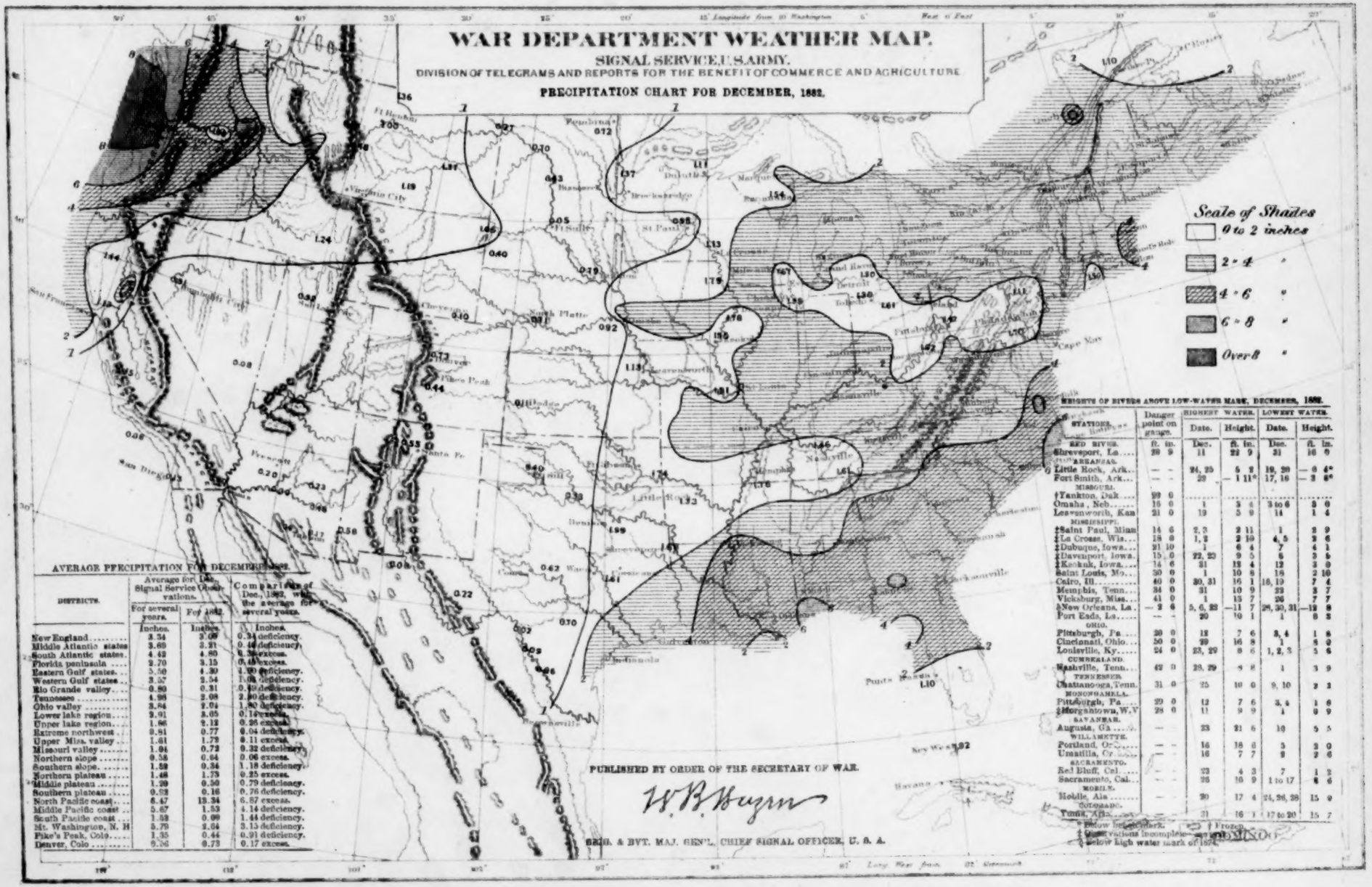
No. III.

WAR DEPARTMENT WEATHER MAP.

SIGNAL SERVICE, U.S. ARMY.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

PRECIPITATION CHART FOR DECEMBER, 1882.



AVERAGE PRECIPITATION FOR DECEMBER.

DISTRICTS.	Average for Dec., Signal Service Observations. For several years.	For 1882.	Comparison of Dec., 1882, with the average for several years.
	Inches.	Inches.	Inches.
New England	3.34	2.00	0.34 deficiency.
Middle Atlantic states	3.69	3.21	0.48 deficiency.
South Atlantic states	4.42	4.80	0.38 excess.
Florida peninsula	2.70	3.15	0.45 excess.
Eastern Gulf states	5.50	4.30	1.20 deficiency.
Western Gulf states	3.57	2.54	1.03 deficiency.
Rio Grande valley	0.80	0.31	0.49 deficiency.
Tennessee	4.98	2.98	2.00 deficiency.
Ohio valley	3.84	2.04	1.80 deficiency.
Lower lake region	2.91	3.05	0.14 excess.
Upper lake region	1.86	2.12	0.26 excess.
Extreme northwest	0.81	0.77	0.04 deficiency.
Upper Miss. valley	1.61	1.72	0.11 excess.
Missouri valley	1.04	0.72	0.32 deficiency.
Northern slope	0.58	0.64	0.06 excess.
Southern slope	1.52	0.34	1.18 deficiency.
Northern plateau	1.48	1.73	0.25 excess.
Middle plateau	1.20	0.50	0.70 deficiency.
Southern plateau	0.52	0.16	0.36 deficiency.
North Pacific coast	6.47	12.34	5.87 excess.
Middle Pacific coast	5.67	1.53	4.14 deficiency.
South Pacific coast	1.53	0.09	1.44 deficiency.
Mt. Washington, N. H	5.79	2.64	3.15 deficiency.
Pike's Peak, Colo	1.35	0.44	0.91 deficiency.
Denver, Colo	0.86	0.73	0.17 excess.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

W. B. Hazen

BRIG. & BVT. MAJ. GEN'L, CHIEF SIGNAL OFFICER, U. S. A.

HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, DECEMBER, 1882.

STATIONS.	Danger point on gauge.	HIGHEST WATER. Date.	Height.	LOWEST WATER. Date.	Height.
	ft. in.	Dec.	ft. in.	Dec.	ft. in.
RED RIVER.					
Shreveport, La	39 9	11	22 9	31	16 9
ARKANSAS.					
Little Rock, Ark	— —	24, 25	5 2	19, 20	— 0 4*
Fort Smith, Ark	— —	29	— 1 11*	17, 18	— 3 8*
MISSOURI.					
†Yankton, Dak	20 0				
Omaha, Neb	15 0	1	3 4	3 to 6	2 0
Leavenworth, Kan	21 0	19	5 9	14	1 4
MISSISSIPPI.					
†Saint Paul, Minn	14 6	2, 3	2 11	1	2 9
†La Crosse, Wis	18 0	1, 2	2 10	4, 5	2 6
†Dubuque, Iowa	21 10	1	6 4	7	4 1
†Davenport, Iowa	15 0	22, 23	9 5	6	5 5
†Keokuk, Iowa	14 6	31	12 4	12	3 0
Saint Louis, Mo	30 0	1	10 8	18	2 10
Cairo, Ill	40 0	30, 31	16 1	16, 19	7 4
Memphis, Tenn	34 0	31	10 9	23	3 7
Vicksburg, Miss	41 0	1	13 7	26	7 7
†New Orleans, La	— 2 6	5, 6, 22	— 11 7	28, 30, 31	— 12 6
Port Eads, La	— —	20	10 1	1	0 3
OHIO.					
Pittsburgh, Pa	30 0	12	7 6	3, 4	1 6
Cincinnati, Ohio	50 0	29	16 8	1	8 0
Louisville, Ky	24 0	23, 29	9 6	1, 2, 3	5 6
CUMBERLAND.					
Nashville, Tenn	42 0	28, 29	8 8	1	3 9
TENNESSEE.					
Chattanooga, Tenn	31 0	25	10 0	9, 10	2 2
MONONGAHELA.					
Pittsburgh, Pa	22 0	12	7 6	3, 4	1 6
†Morgantown, W. V	28 0	11	9 9	1	0 9
SAVANNAH.					
Augusta, Ga	—	23	21 6	10	5 5
WILLAMETTE.					
Portland, Or	— —	16	18 6	5	2 0
Umatilla, Or	— —	16	7 7	2	2 6
SACRAMENTO.					
Red Bluff, Cal	— —	23	4 3	7	1 3
Sacramento, Cal	— —	26	10 9	1 to 17	6 6
MOBILE.					
Mobile, Ala	—	20	17 4	24, 26, 28	15 9
COLORADO.					
Yuma, Ariz	—	31	16 1	17 to 20	15 7

* Below low-water mark. † Frozen.

Observations incomplete and unreliable.

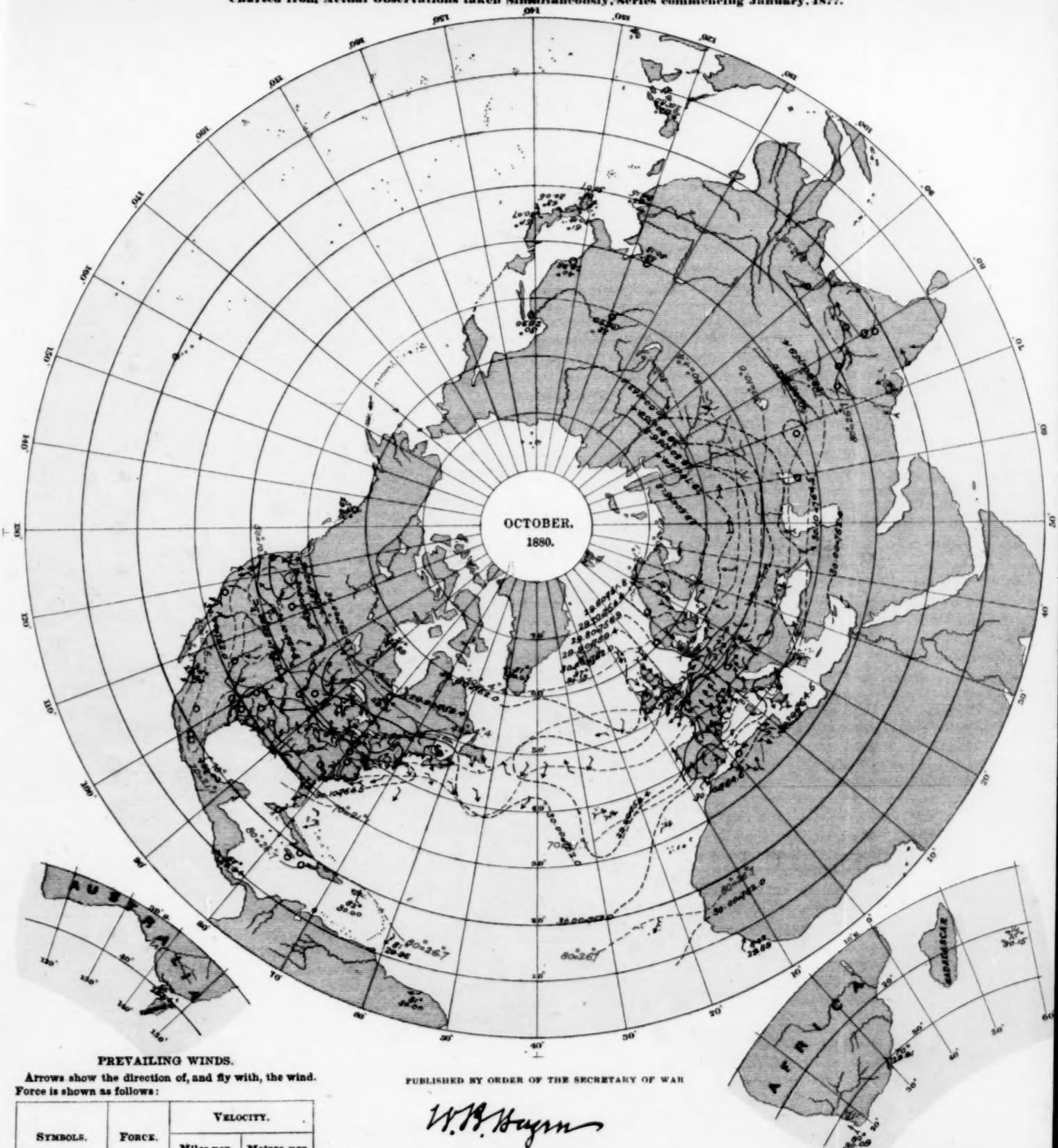
Below high water mark of 1874.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.

No. IV.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
○	0	0	0
→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up.	30.2 & over.

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W. B. Hazen

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue;* detached barometer means in English inches.

Isotherms in *red;* detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

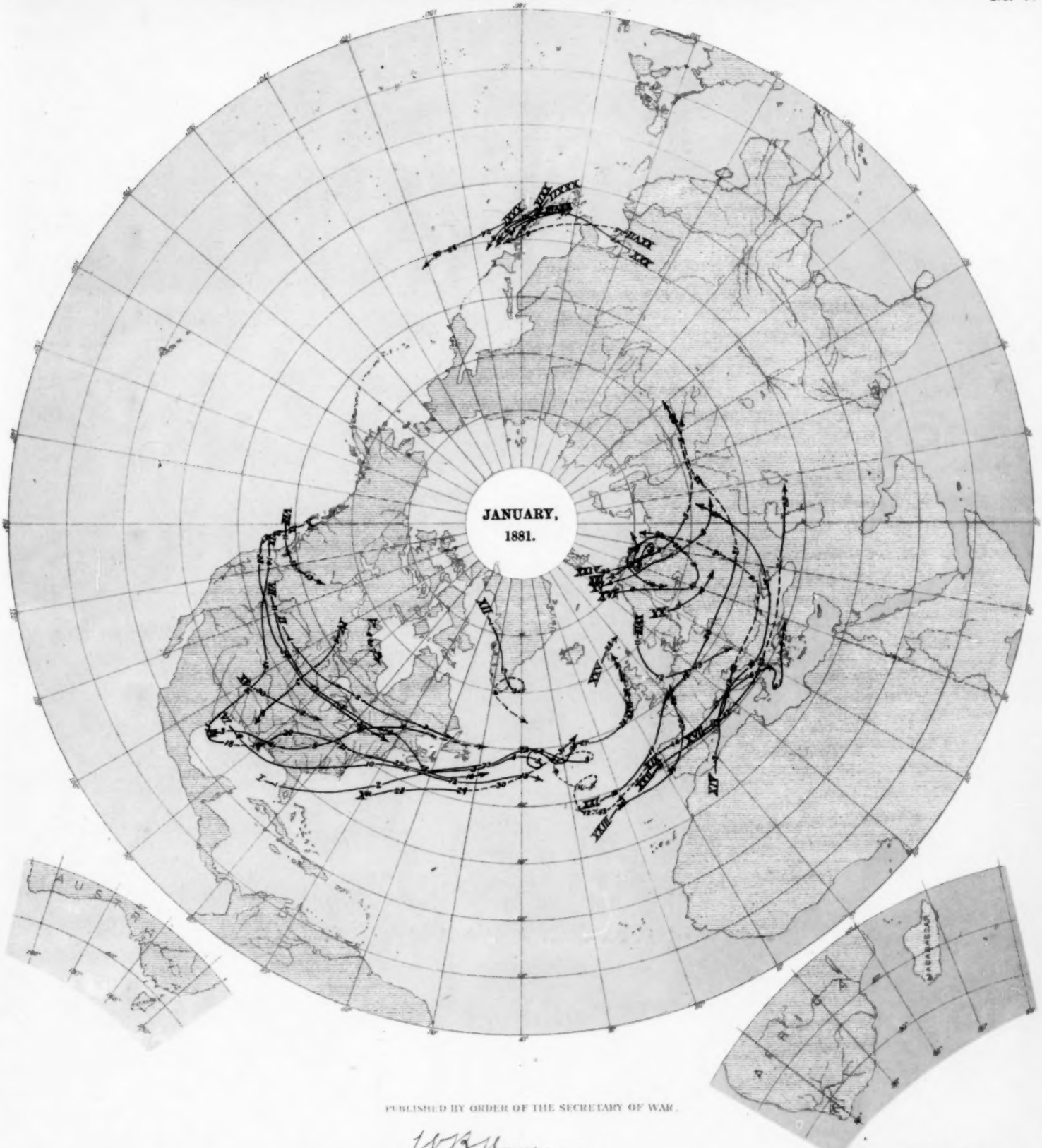
Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of October, 1880, based on the daily charts of the International Bulletin.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing November, 1877.

No. V.



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Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for January, 1881,

Heliotype Printing Co Boston